Ministry of Environment

Annual Report

1982/83

Ministry of Environment Annual Report 1982/83

Province of British Columbia

Ministry of Environment

Honourable Stephen Rogers,
Minister

B.E. Marr
Deputy Minister

VICTORIA, BRITISH COLUMBIA

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To His Honour the
Lieutenant-Governor of
the Province of British Columbia

MAY IT PLEASE YOUR HONOUR

Herewith I beg respectfully to submit the Annual Report of the British Columbia Ministry of Environment for the period April 1, 1982 to March 31, 1983.

Stephen Rogers
Minister of Environment

The Honourable Stephen Rogers
Minister of Environment

SIR:

I have the honour to submit the Annual Report of the British Columbia Ministry of Environment for the period ended March 31, 1983.

B.E. Marr
Deputy Minister

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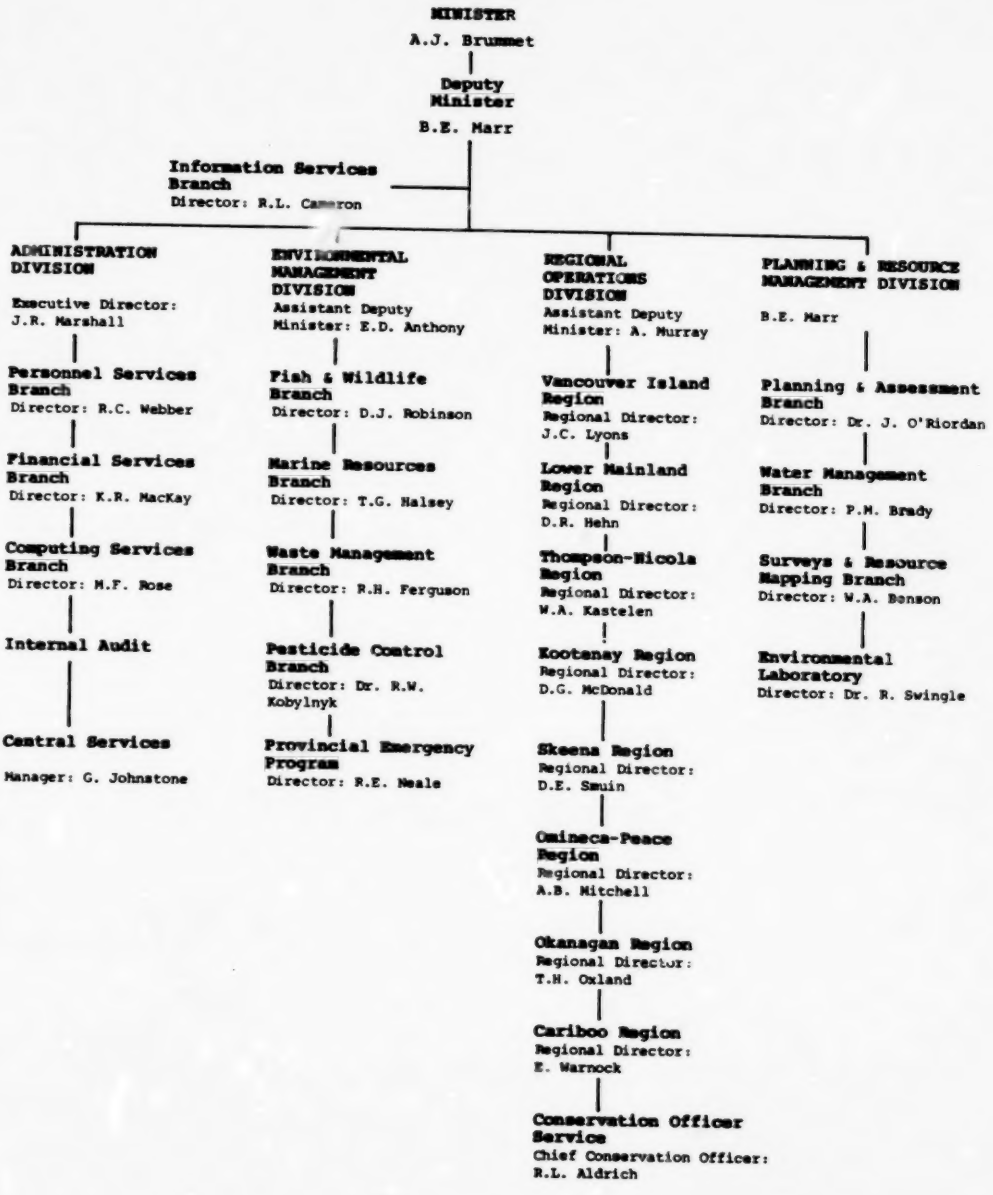
Ministry of Environment



Administration Division

General Administration Program

The General Administration Program, under the direction of the executive director, is responsible for the support of ministry operations by providing executive direction, coordination and information, personnel, finance, systems, space, laboratory, enforcement, communications and general administrative services.

INFORMATION SERVICES BRANCH

The communication program continued to concentrate on making the public aware of the ministry's mandate to maintain a quality environment for people, fish and wildlife. Information programs demonstrated how environmental management could promote a healthy environment in association with social and economic development.

Major initiatives included the production of the prestigious book "British Columbia: This Favoured Land", by Liz Bryan. Encouraged and assisted by the ministry, the book was published by Douglas and McIntyre and has become the official gift book of the province.

Service to the public increased with the addition of a regional information officer in the Okanagan, joining officers in Surrey, Prince George and Kamloops. The Minister's Environmental Awards recognized the contributions of both industry and public organizations.

In addition to working with the Ministry of Education in reviewing curricula, the ministry identified major concerns for teachers on the topics of waste and resource recovery for the new consumer education course.

Major audio-visual productions dealt with the special waste program and experimental moose management. A special one-hour television program on "Waste: Causes, Costs and Choices" was produced for the Knowledge Network. The broadcast coincided with Canada Environment Week.

The ministry's Conservation and Outdoor Recreation Education program (CORE) conducted 458 courses involving over 12,000 students; 86 percent of students undertook the course to qualify for a B.C. hunting licence.

To ensure that ministry programs reflect the needs and concerns of the community, a broad public opinion poll was commissioned to examine public attitudes toward environmental issues and management. Results indicated that considerable concern for the quality of the environment exists amongst B.C. residents. In fact, their concern appears to be intensifying, since half of those polled supported a step-up in efforts to protect the environment.

The ministry's special mall display, carrying the theme "Environment-It's Your Home", was viewed by over 150,000 people. An additional 50,000 visitors viewed ministry displays at other exhibitions.

Less visible promotions included the production of news releases, fact sheets, information bulletins and a series of community and technical publications. Contact with the public increased as did the demand for signs, photographs, posters and inquiries from the news media.

The ministry's flagship publication Wildlife Review continued to win awards and praise from over 20,000 paid subscribers.

LIBRARY

The ministry library continues to increase in holdings as well as in volume of detailed reference and loan requests. Employees in the smaller regions, as well as in headquarters, are becoming more aware of the services available.

Electronic mail is used daily for transmission of interlibrary loan requests to the National Research Council in Ottawa, the University of British Columbia, the University of Washington, and 35 other college and

institutional libraries in the network.

Word processing has allowed more efficient tracking of the ordering and cataloguing stages of publication receipt and circulation.

Requests are now being streamlined by using one library contact in each region to process orders and loans. Also, beginning this year, regional employees are being trained to do basic cataloguing preparation of their collections.

FINANCIAL SERVICES BRANCH

Financial Services Branch continued to provide accounting services for the ministry including direction and assistance in the preparation of annual estimates, control of appropriations allotted, preparation and distribution of payroll data, processing of accounts payable, billing and collection of revenue and the preparation of various reports and summaries.

Implementation of Treasury Board Financial Administration Policy and the recommendations of the Auditor General, arising from a comprehensive audit of the ministry, were major targets of the branch during the year. Substantial progress was made on the development and implementation of ministry financial policies and procedures.

Under the general requirements of the Financial Administration Act, which was proclaimed in 1981, ministries are required to establish and maintain adequate systems to account for, control and report on financial and physical resources which are their responsibility. During the past year the ministry proceeded with the development of financial systems for revenues, expenditures and fixed assets.

Other significant accomplishments were the successful conversion to a new payroll system, the development of a ministry-wide commitment reporting system and the processing of approximately 43,000 cheque and travel vouchers.

PERSONNEL SERVICES BRANCH

Personnel Services Branch provides services to the ministry in the fields of recruitment and selection, salary administration, job and organizational analysis, contract administration, collective bargaining, employee relations, staff development and safety, manpower planning and records administration.

The ministry was selected as one of the first four ministries to receive delegation of recruitment and selection from the Public Service Commission and was the first ministry to be audited under delegation. This initial audit resulted in a constructive review of our recruitment and selection procedures, and the ministry took the initiative to suggest significant recommendations concerning the audit process, many of which were subsequently adopted by the Public Service Commission. The Deputy Minister has agreed to participate in a follow-up audit during fiscal 83/84 to demonstrate that the ministry standards of recruitment and selection are maintained in accordance with the legislation.

The major ministry reorganization which started in 1980 was largely completed; however, some organizational and job analysis work was still outstanding by year end. Much of the credit for handling the high volume of job analysis work during the fiscal year goes to the auxiliary personnel officers hired and the second Ministry Classification Committee formed to handle the extra volume of work associated with reorganization.

Employee relocations that occurred as a result of reorganization continued during the fiscal year. By year end, 41 of 47 (87%) of the employees who had chosen not to relocate with their positions were successfully placed elsewhere.

The B.C. Government and the ministry survived its first major strike during the summer of 1982. Plans made by the ministry prior to the strike served the ministry well. Inconvenience to the public was minimized, and essential services were maintained with minimum loss.

One effect of the Government Restraint Program was a downturn in recruiting activity during the year. A consequence was an increase in classification appeals and employee grievances. At the same time this

permitted additional activity in job analysis plus development and review of classification series such as the Laboratory Scientist Series and the proposed Environmental Technician Series. Other initiatives undertaken during the year included updating and conversion of all ministry personnel policies and procedures to the new standarized ministry format, developing and conducting training sessions on the new BCGEU collective agreement and preliminary development of computerized personnel systems for position control, benefits and leave management.

Significant advances were made this year in the implementation of a performance-based model for staff development and safety by the Staff Development and Safety Section.

Through the building of knowledge and skills in staff development and safety among regional and branch employees, the ministry is creating a work force capable of maintaining and improving its performance as government programs and priorities change. By building internal expertise, we maximize our potential cost-effectiveness and productive capacity.

Training programs were offered in all areas of the ministry's work from wilderness survival to management training to snow survey training. Special attention was given to bolstering the safety function through a revised safety policy and committee structure in anticipation of a new program of safety committee training.

A new planning and budgeting system was devised to integrate staff development and safety into the operational planning process.

All program/project priorities for the section which were established by regions, branches and Executive Committee for this year were achieved. In addition, 23 priority programs emerged from work with regions and branches during the year. Forty percent of the programs were conducted using in-house resources. Sixty percent of programs provided had no cost other than travel. Program attendance more than doubled this year to a total of 1,760 program participants.

CENTRAL SERVICES UNIT

Central Services continues to meet the accommodation requirements of the ministry, to administer inventory control of all vehicles including purchasing and insurance, to provide other support services including mailroom/courier, parking, security, furnishings, photocopiers and warehousing, and to plan, budget and acquire all telecommunications services.

The accomplishments of this unit during the past year include the following:

- Accommodation arranged for some 1,500 personnel, including completion of new accommodation for the ministry's regional headquarters in Williams Lake.
- 211 requests for telecommunications service processed, including the installing of circuits to expand the ministry's electronic mail service.
- Quarterly editions of a ministry-wide Postal Address and Telephone Directory.
- Registration and insurance for 959 motor vehicles and other mobile field equipment processed.
- Supply and maintenance of 55 photocopiers administered.
- 672,000 pieces of incoming and outgoing mail handled.
- A system of supply and distribution of uniforms for the ministry's Conservation Officer Service developed and implemented.

COMPUTING SERVICES BRANCH

Computing Services Branch continues to provide cost-beneficial computing, word processing and systems services to ministry staff in support of the ministry's programs.

During the 1982/83 fiscal year the emphasis of the branch's work was on consolidating the many small systems to bring them under release control and to begin reviews of major systems that had been operational for over eight years, with the intent of validating their continued need and investigating avenues for cost savings.

A laboratory sample management system was installed in the Kelowna Soils Laboratory in conjunction with the update of the B.C. Soil Information System.

Projects were initiated to upgrade the computer support system to the Environmental Laboratory in Vancouver and to review and develop requirements for an improved environmental quality data management system and a wildlife data management system.

A permanent-hunter number data system was developed to consolidate the hunter licensing data and to cut down significantly on keypunching names and addresses for the Limited Entry Hunting Draw conducted annually.

End-user computing and increased use of ministry word processors for records management have provided many ministry staff with time and labour-saving tools. Computing Services Branch has provided support, training and central information on available applications.

CONSERVATION OFFICER SERVICE

The objectives of the Conservation Officer Service are to ensure compliance with ministry legislation by:
(1) providing a viable prevention program through public education and involvement;
(2) providing an environmental surveillance and protection program;
(3) providing a patrol and investigative capability in order to apprehend violators, deter would-be violators and to institute proceedings for prosecu tion under legislation for which this Ministry has responsibility; and
(4) providing for the protection of the public and property from problem wildlife.

The Conservation Officer Service consists of 91 field officers, eight senior conservation officers, eight regional conservation officers and four Victoria headquarters staff.

Statistics 1982(Total)	1981 (increase/decrease)
3,780 violations reported by public	+ 63%
4,177 violations found by conservation officers	+108%
2,236 Court proceedings instituted	+ 17%
1,540 convictions registered (69% rate)	+ 12%
2,149 warnings issued	+106%
1,338 cases unsolved	+ 45%
$ 169,182 in fines levied	+ 18%

The Conservation Officer Service is involved in the following four programs:

Wildlife Program

The following acts are enforced:
Wildlife Act
Firearm Act
Migratory Birds Convention Act
Game Export Act

Conservation officers spent 44% of their total time on wildlife enforcement duties.

Statistics 1982	1981 (increase/decrease)
2,538 violations reported by public	+ 57%
2,572 violations found by conservation officers	+ 88%
-525 violations unfounded	
4,585 total actual violations	+ 59%
1,486 Court proceedings	+ 57%
989 convictions (67%)	- 14%
1,192 warnings issued	+ 74%
975 cases unsolved	+ 28%
$108,056 fines levied	+ 43%

Conservation officers spent 9% of their time handling nuisance or dangerous wildlife complaints and responded to 1209 of 4103 complaints from the public in this regard, as follows:

	Complaints Rec'd	--Act on
Black bear	1,231	609
Grizzly bear	72	40
Cougar	257	108
Wolf	229	101
Other	2,314	351

Fisheries Program

These Acts are enforced:
Federal Fisheries Act
Fisheries Act (Provincial)

Conservation officers spent 12.5% of their operational time on fisheries and habitat protection duties.

Statistics 1982	1981 (increase/decrease)
860 violations reported by public	+ 49%
1,314 violations found by conservation officers	+256%
655 Court proceedings instituted	+ 98%
517 convictions registered (79% rate)	+146%
823 warnings issued	+155%

311 cases unsolved	+130%
$52,976 fines levied	+ 35%

Waste Management Program

The following Acts are enforced:
Waste Management Act
Environment Management Act
Litter Act

Conservation officers spent a total of 2.85% of their operational time on the enforcement of waste management legislation.

Statistics 1982	1981 (increase/decrease)
250 complaints reported by public	+301%
192 violations found by conservation officers	+300%
70 Court proceedings instituted	+ 49%
31 convictions registered (44% rate)	+ 55%
79 warnings issued	+295%
40 cases unsolved	+ 74%
$7,575 fines levied	- 43%

Water Management Program

This program enforces the Water Act.

Conservation officers spent a total of 1.1% of their operational time on enforcement of the Water Act.

Statistics 1982	1981 (increase/decrease)
78 complaints reported by public	+866%
29 violations found by conservation officers	+360%
8 Court proceedings instituted	- 20%
1 conviction registered (12.5% rate)	- 88%
31 warnings issued	--
$350 fines levied	-285%

Other

Conservation officers, in the course of their duties, lay charges under various other Acts, including the Criminal Code. In the year 1982/83, 17 charges were laid under other Acts resulting in 2 convictions, with a total of $225 in fines being levied.

Prevention

Conservation officers spent a total of 5,484 man-hours on community information and education related activities, representing 3.4% of their time.

Training

Thirty conservation officers received enforcement training through the Justice Institute.

This, and other training (small boats, firearms, supervision, etc.) amounted to 7,445 hours, or 8.7% of their time.

The enforcement training course was developed by the Conservation Officer Service with assistance from the Justice Institute. During this reporting year, five officers from the Yukon Wildlife Service and eight officers from the Provincial Parks Branch attended in addition to the ministry's own staff. Enquiries have also been received from the Alberta Fish and Wildlife Branch with a request for seats on any subsequent enforcement training courses.

COMMENTS

Despite the fact that the Conservation Officer Service has ten vacant positions effectively reducing field manpower to 91 staff, the workload handled has increased considerably. The reported and found violations (a total of 7957) represent a combined increase of 84%. Significant successful investigational activity is especially evident in the wildlife and fisheries management programs and to a lesser, but no less important extent, in the waste management program.

These results can be attributed in large part to the increasingly sophisticated and professional capabilities of conservation officers, through the innovation of new data collection systems, better organizational planning, increased supervisory and management skills, technical and human relations training and an increased dedication to the ministry's mandate.

PLANNING AND ASSESSMENT BRANCH

During 1982/83 the Planning and Assessment Branch was created by the

merger of two formerly separate Planning and Assessment Branches. The rationale for this merger was the reduction in the size of the management component of the unified branch in the interest of restraint in government, and the desire to link the planning and assessment processes more closely. Functionally, the new branch retains four major areas of activity: strategic and operational planning; guidelines and review; environmental and socioeconomic projects and program evaluation analysis.

Strategies and Operational Planning

The main planning role of the branch is to coordinate the preparation of sub-regional strategic environmental management plans for approximately 40 planning units of the province. These plans embrace all of the resource management programs of the ministry, and require coordination of staff in regions and Victoria-based branches at both the policy and operational levels. These plans are designed to enable the ministry to set out clearly its management objectives and the activities that must be undertaken to achieve those objectives, for each resource program under its mandate. These objectives are set after an analysis of the options to balance public demand with resource supply at different levels of management.

The 1982/83 fiscal year was the first in which the planning unit of the branch was fully staffed and operational. During the year the plan for the Nicola unit was completed, and four others - Elk/Flathead, Finlay-Omineca, Peace, and Upper Columbia - reached a stage where they will be finalized in the late summer of 1983. Three other plans - Skeena-Nass, Thompson-Bonaparte and Fraser-Delta - were initiated during the year and were expected to be finished in early 1984.

Because ministry plans must eventually be integrated with those of other ministries and levels of government, the branch spent considerable time liaising with other government agencies. Protocol agreements were developed with the Ministry of Agriculture and Food, discussions were held with the Ministry of Forests on the linkages between the planning programs of the two Ministries, and the branch continues to work cooperatively with the federal Ministries of Fisheries and Oceans and Environment in technical analysis and information exchange related to environmental planning.

The branch also assists regional staff in operational level planning where these plans must be placed in a broader context or where some coordination is required across ministry programs. During the year the branch participated in the following areas of operational planning:

(a) Coordination of ministry responses to ten Official Settlement Plans being prepared by Regional Districts and to three Crown land planning initiatives of the Ministry of Lands, Parks and Housing.

(b) Developing ministry position papers on major developments such as the Site C hydro project and the Sage Creek Coal project which assessed the effect of the identified environmental impacts of these projects on the ability of the ministry to meet its management objectives.

Guidelines and Review

METAL AND COAL MINES REVIEW

The Assessment Branch represented the ministry on the Provincial Coal Guidelines Steering Committee and Metal Mines Steering Committee in the review of projected coal and metal mine developments under established provincial guidelines. The objective was to coordinate the ministry review of proposed developments, to develop a consolidated position in cooperation with the regions, and to present this position as required to the Ministry executive, and to the appropriate inter-ministry Steering Committee for approval by the Environment and Land Use Technical Committee. Major project reviews underway in 1982/83 included some 50 projected developments such as Quinsam Coal, Westmin Resources, Sage Creek Coal, Fording

Coal Expansion, and Bralorne.

The branch provided assistance to North Region, Ministry of Environment, in the continuing environmental review of projected North East Coal developments.

LINEAR ASSESSMENT AND REVIEW

The planning of electrical transmission lines, pipelines, highways and major resource roads continued to place heavy demands on ministry staff, the Ministry of Energy, Mines and Petroleum Resources, other resource agencies and energy project proponents in securing environmental safeguards for five high-voltage transmission lines, the proposed Vancouver Island gas pipeline and three highway and resource road proposals.

The Utilities Commission Act (1981) accommodated many of the major linear project types formerly reviewed under the Guidelines for Linear Development. The branch was responsible for the administration of the latter on an inter-ministry basis, and for liaison with the Regional Resource Management Committee as to project-review designation under guidelines or under regional referral. The objective was to provide an inter-ministry framework, operating under updated guidelines, for the provincial review of linear projects not covered by the Utilities Commission Act.

SURVEILLANCE AND MONITORING

In cooperation with developers and government agencies, the branch is responsible for establishing procedures and standards for project environmental surveillance, supervision and monitoring programs for all stages of a resource development. During 1982/83, activities included preparation of standard procedures for environmentally sensitive construction practices (eg. stream crossings), development of procedures for environmental surveillance and supervision of major development projects (Kelly Lake - Cheekye 500 kv Transmission Line), and development coordination of monitoring programs for major projects (e.g. multiple developments in the Prince Rupert area).

Environmental Projects and Programs Evaluation

PRELIMINARY ENVIRONMENTAL ASSESSMENT/ENVIRONMENTAL PROBLEM ANALYSIS

The objective is to identify and assess the broad environmental consequences of major development proposals at an early stage in the planning process. The results of these evaluations contribute to the development of a ministry position regarding the proposal and the determination of the most appropriate type and level of further environmental assessment, if warranted. Projects reviewed by this process in 1982/83 included Offshore Petroleum Exploration and Development.

ORDER-IN-COUNCIL ADMINISTRATION AND ESTUARY MANAGEMENT PLANNING

The branch is responsible for the administration of Orders-in-Council 908/77 and 3339/77 which provide for mandatory environmental impact assessment of all development proposals in the outer Fraser and Cowichan estuaries, respectively. In addition, the branch participated in the development of the Fraser, Cowichan and Squamish estuary management plans through the provision of resource planning assistance. As Implementation Coordinator, the branch has assumed the lead role in the implementation of the recommendations of the Cowichan Estuary Task Force Report, including the operation of an office in Duncan.

FEDERAL GOVERNMENT INITIATED PROJECTS

The branch serves as provincial representative on major proposal reviews initiated by the federal government and is responsible for coordinating the presentation of provincial environmental interests in relation to each project. Projects which have been handled in this manner during 1982/83 included the Roberts Bank Port Expansion, Canadian National Railway Twin Tracking, and

Vancouver International Airport Expansion.

ENVIRONMENTAL LIAISON

The branch participates in a number of committees intended to increase the ministry's awareness of environmental issues and to provide a forum for our input into the resource assessment and operational planning activities of other groups. During 1982/83, branch involvement included representation on the Sea Use Coastal Advisory Board, Puget Sound Coastal Planner's Group, Port of Vancouver Master Plan, and the Pacific Sub-committee on Oceanography.

ENERGY REVIEW PROCESS

The branch is closely involved with the Energy Review Process as a member of the Energy Project Coordinating Committee and Chairman of the Environment/Resource/Land Use Working Committee. Ministry of Environment and other provincial agency comments on each proposal are coordinated and presented to the E/R/LU Working Committee as part of the overall review process. Projects reviewed under this process in 1982/83 included:
Kelly Lake - Cheekye Transmission Line; Western Liquid Natural Gas Terminal and Pipeline; Vancouver Island Natural Gas Pipeline Alternative; Stikine-Iskut Hydro-electric Generation Projects; Prince Rupert Area Petrochemical Terminal Alternatives.

SOCIOECONOMIC ANALYSIS

Economic analysis services are provided to the Ministry as a whole by the Socioeconomic Analysis Unit. During 1982/83 the provisions of service was split almost equally between support to strategic planning and project assessment; and to meeting the demands of the other programs of the ministry. In planning and assessment projects an economic analyst is assigned to each planning or assessment team to undertake work on the present and expected future use of environmental resources and to analyse the economic characteristics of alternative management options. In addition the unit provides in-house expertise in the conduct of public consultation activities related to planning and assessment. In these ways the unit provides specialist advice to virtually all the plans and projects identified in the preceeding sections.

In addition the socioeconomic analysis services are provided on request to all ministry branches and programs, and to the Executive Committee. Examples of studies undertaken during 1982/83 included the economics of recycling and resource recovery in government, analysis of the value of fish and wildlife to residents and non-residents in British Columbia, analysis of the structure and licensing of fish buyers in British Columbia, the potential demand for drinking water by markets outside British Columbia, and a review of government policy on compensation and mitigation for loss of environmental resources in economic development projects.

ENVIRONMENTAL LABORATORY

The Environmental Laboratory provided services for chemical and biological analysis of environmental samples to the Ministry of Environment, Ministry of Forests, Ministry of Agriculture and Ministry of Health. It also provided services at cost to Crown corporations such as B.C. Hydro. The provision of a special water analysis service to the general public continued. During the period April 1, 1982 to March 31, 1983, the laboratory performed 198,922 routine tests equivalent to 2,502,280 workload units and analyzed 870 water samples for the general public. It also undertook 86 legal cases.

The SAMAN Computer system design was initiated and is continuing. The Billing and Time Management System should be fully operational by September, 1983 and the complete system by April 1984.

Legal seminars were given in five regions this fiscal in a continuing effort to improve the legal capabilities of the field and laboratory.

OPERATIONS

The Operations Division was established as a result of reorganization of the Enironmental Laboratory in December 1982. In addition to the existing services, a new Rapid Analysis Service was formed to provide closer liaison with the client agencies and to expedite requests for rush analyses. Early in 1983 the Field Co-ordinator, responsible for Rapid Analysis, visited the regional offices to assess their requirements and implement additional laboratory services required by the client agencies.

The Operations Division provided analytical chemical services for testing of water, wastewater, sediments, biological materials and ambient air samples. Tests were performed for inorganic, organic and pesticide parameters. In December 1982 routine testing of air samples was transferred to the Operations for Special Services. During 1982/83 fiscal year, 184,133 routine tests equivalent to 1,870,528 workload units were performed. From January 21, 1983 to March 31, 1983, 183 samples were analyzed for ruch analyses.

During the year the staff of the Operations Division participated in the following:

- Development work on SAMAN Project, the new computer facility for the laboratory.
- Compilation of information on methodology for methods of Aquatic Data Collection: Catalogue.
- Eight federal Interdepartmental Committee on Pesticides quality control programs for analyses of pesticides and organics.

Completed projects included:

- Analyses of organics in Ladysmith Harbour.
- Refinement and introduction of methodology for analyses of trihalomethanes in water.
- Development of block digestion method using hydrogen peroxide/sulphuric acid for conversion of Kjeldahl nitrogen.
- Development of methodology for analyses of diphacinone and strychnine.
- Development of methodology for analyses of metaldehyde in water.

SPECIAL SERVICES

The Special Services Division continued to provide services in the areas of both air quality monitoring and biological testing.

During 1982/83 the Biology Section completed 11,000 taxonomic identifications of fresh water plankton, periphyton and invertebrates. The section carried out 2,124 routine biological tests equivalent to 55,853 workload units. In addition 190 LC50 and LT50 fish bioassays were carried out; included were 25 samples where potential legal action was designated. Microtoxicological testing was continued and 208 samples were analyzed. Project work, authorized by the Waste Management Branch, was initiated in the specialized areas of acute Daphnia bioassay (113 samples were processed), analysis of sediment diatoms and algal bioassays. The work on acute Daphnia bioassay is complete and the service is now offered routinely. Participation on the Provincial Task Force addressing "Provincial Guidelines and Laboratory Procedures for Measuring Acute Lethal Toxicity of Liquid Effluents to Fish" was continued and a final report was published by the ministry.

During 1982/83 the Air Quality Sections continued to provide quality control administration, laboratory analyses and a data reporting service for ministry air quality monitoring within the province. Twenty-eight continuous monitors were operated at 17 air quality monitoring stations. In addition 12,665 laboratory analyses of airborne materials equivalent to 575,899 workload units were carried out. Project work, authorized by the Waste Management Branch, either continued or was initiated, in the specialized areas of source testing, precipitation monitoring, fluoride monitoring, coal dust monitoring and automated data capture for continuous monitors. Reports dealing with all of this work are available. In addition 4 new operations manuals, dealing with procedures for Source Testing, Air Quality Monitoring, Laboratory Analyses and Continuous Monitors, were published by the Environmental Laboratory during 1982/83. An audit of the performance of all continuous air quality monitors

operated by industry was initiated and it is currently planned that this program will continue on an annual basis. Participation on the Quality Assurance Sub-Group of the Federal-Provincial Committee dealing with the "Long Range Transport of Acid Pollutants" was continued.

Environmental Management Division

Fisheries Management/ Wildlife Management Programs

ADMINISTRATION

Nearly 900,000 hunting and angling licences were sold in 1982/83, generating $9.98 million in gross revenue. An additional $78,000 was realized from the sale of commercial licences (trapping, guiding, and fur trading) and $125,000 from payment of royalties on furs.

Expenditures under the Fisheries and Wildlife Management Programs totalled $17.7 million, including $2 million as the provincial share of the federal/provincial Salmonid Enhancement Program, and activities funded totally by B.C. Hydro as compensation for, or mitigation of, the effect of major power generation projects on fish and wildlife resources.

GUIDED HUNTING

Big game guiding activities generated approximately 14.5% of the total fish and wildlife revenue to the province. Guide outfitters provided guiding services to 3,329 hunters. Guided hunters included 177 residents, 97 non-resident Canadians and 3,056 non-resident aliens. Non-resident alien hunters came from every state in the United States and from 19 other countries. These hunters harvested a total of 3,106 game animals. Guiding activities brought an amount estimated to be in excess of $14 million into the British Columbia economy.

In 1982 there were 262 active guide outfitters. These guide outfitters hired 1,054 assistant guides (735 were active) plus cooks, wranglers and expediters. 161 small game and angling guides were licenced.

WILDLIFE PROGRAM

The primary goal of the Wildlife Program is to maintain the wildlife species of the province in sufficient abundance to meet the social, recreational, ecological and economic needs of society. Wildlife management activities include inventory and management of wildlife populations, maintenance and enhancement of habitat, and regulation of hunting and trapping harvests.

On July 28, 1982 a new Wildlife Act was proclaimed. The first major revision of the province's wildlife legislation in a decade and a half, the new Act reflects changing public attitudes toward wildlife and wildlife management.

A survey of hunters was completed during the year. The results, when analyzed, will indicate hunters' expenditures and their preferences for certain areas of the province and particular game species. A parallel survey of non-hunters was designed and tested for general application in 1983/84.

"Black and Green", a film on the use of fire in forest and wildlife management, was produced jointly with the Ministry of Forests.

Wildlife Inventory

Big game inventory effort was increased in all sections of the province. Emphasis was placed on improving information required for management of moose, mountain goat, and caribou.

1982 Hunting Season

Probably as a result of the increase in licence fees, hunting licence sales fell about 10%.

Applications for limited entry hunts increased about 40%. There was an increase of 20% in the available authorizations. Limited

entry hunters averaged 68% success in their hunts.

The hunter take of elk was up over both the 1981 harvest and the longterm average harvest. The moose take was above the 1981 harvest but 9% below the five-year average. The deer take was down 13% from 1981, but was 6% above the five year average.

Endangered Species

Fish and Wildlife personnel conducted extensive surveys for the Vancouver Island marmot. In a thorough search of twenty-two areas, 409 active burrows were found and 148 marmots were observed. In March, 1983 a detailed plan, "Status and Management of the Vancouver Island Marmot", was released for public review.

A recovery plan for the burrowing owl, an endangered species in British Columbia, was drafted. All preparations were made to reintroduce the owls in the Douglas Lake area and at a site in the Okanagan.

Trapping

Approximately 500 students completed the Trapper Education course during the year. The course promotes humane trapping and better pelt preparation.

British Columbia's raw fur industry produced $3.7 million worth of furs in 1982/83.

New trapping regulations further curbed the use of leg-hold traps, virtually prohibiting their use for trapping wolverine, marten, fisher, weasel, skunk, squirrel and raccoon. Stricter regulation of the use of leghold traps for taking aquatic animals was instituted also. A Trapper Assistance Program was instituted and $50,000 allocated for 1982 to help trappers obtain humane traps. A Trapper Advisory Committee was set up to administer the fund and assist in framing trapping regulations.

Bighorn Sheep Die-Off

A major die-off of Rocky Mountain bighorn sheep in the East Kootenays began in December, 1981 in an area where domestic sheep had come into contact with the bighorns. Before long most East Kootenay herds had been hit, the sheep dying of stress-related pneumonia. Top experts on wild sheep disease met in Cranbrook to examine the problem and make recommendations for management and research aimed at averting or controlling future die-offs.

Problem Wildlife

There was no major change in predator/livestock problems during the year. Although in some northern areas complaints of livestock losses decreased, wolves continued to cause serious concern to ranchers and farmers. Increased emphasis was given to trapping and shooting as control measures, though careful placement of individual 1080 baits remained the most effective technique under a variety of conditions. At least 100 problem wolves were removed within livestock conflict areas.

Reports of problem bears decreased significantly, in part because of improved waste and property management,and also because of the adopted policy of destroying, rather than translocating, problem bears that had become conditioned to feeding on garbage.

Favourable weather averted major agricultural damage by elk, deer and waterfowl in 1982, but the potential for such damage remained a major concern to producers and the government agencies involved. Preventive management through cooperative projects is being emphasized increasingly. Examples are wildlife winter range enhancement projects and fencing projects on chronic damage areas.

Wildlife Research

INTEGRATED WILDLIFE/INTENSIVE FORESTRY RESEARCH

Initiated in late 1980, this five-year program explores the effects of intensive forest practices on blacktailed deer and Roosevelt elk and

their Vancouver Island habitat. Funded and administered jointly by the Ministries of Forests and Environment, the program draws up support and expertise from government, industry and universities in a cooperative way. The planning phase is essentially completed and now the emphasis is on data collection for three interlocked topics: habitat needs of deer, habitat needs of elk, and effects of silvicultural practices on habitat.

GRIZZLY BEARS AND COASTAL DEVELOPMENT, KIMSQUIT RIVER

The first field season was completed successfully for this five-year, joint Forests-Environment investigation into the effects of forestry activities on grizzlies and their habitat. A total of 12 grizzlies and 22 black bears were trapped, of which 8 grizzlies were fitted with radio transmitters. Preliminary information was collected on home range size, movements, diet, and den site selection; results were summarized in an annual report. Other reports prepared were a problem analysis, a project working plan, and a bear biology/project description package.

WILDLIFE HABITAT HANDBOOK

A new project this year, the habitat handbook is a cooperative attempt to synthesize available understanding of habitat needs for all vertebrate species; and to present it in a clear, concise format so that forest and wildlife managers have an improved basis on which to assess consequences of forest activities on wildlife and their habitats. Modelled after successful ventures in the United Stated, this project emphasizes the collation of existing information rather than the collection of new information. The first stage of the study is to develop a prototype handbook for the Kamloops area.

EFFECTS OF WOLF PREDATION ON CARIBOU

Field surveys in northern B.C. were completed for this comparison of wolves and caribou on an experimental wolf removal area with comparable animals on an undisturbed area. Initial analyses suggest that wolf removal does result in increased recruitment for caribou, that wolf numbers can increase rapidly after removal is stopped, and that weather can influence caribou recruitment. A job completion report, now in preparation, will present detailed analyses and interpretation of data collected since 1977.

CENSUS TECHNIQUES FOR DEER AND MOOSE

The current status of census methodology for these two species was reviewed in order to assess research needs. The following four topics were recommended for future work on moose: assess the feasibility of using harvest statistics to develop population estimates; estimate adult mortality rates for various ecological regions of the province; develop interactive computer-based population models; and evaluate the additive and compensatory nature of hunting mortality. A review of provincial moose management strategies was recommended as well.

COMPENSATORY AND ADDITIVE NATURE OF HUNTING MORTALITY IN MOOSE

A report was begun on this topic for the Canadian Committee on Ungulate Management. Density dependent responses, the basis for compensatory mechanisms in hunting, are being reviewed, as well as the importance of confounding environmental effects on these responses. Most provinces view hunting as largely additive to natural mortality, partly because the degree of compensation is unknown, and additivity is viewed as the safest and most conservative management policy. Recommendations for future management and research on moose mortality will be outlined.

ESTIMATING POPULATION CHARACTERISTICS FROM HUNTER HARVEST

In a cooperative study with The University of British Columbia, a model was developed to compute the likelihood of discerning a specific pattern of harvests from a wildlife population. A scheme was then

developed whereby, given a set of harvest data, the numbers, sex and age ratios, and other characteristics of the wildlife population, could be reconstructed. The scheme has been applied to brown bear harvest data demonstrating its potential value as a management tool.

THE FISHERIES PROGRAM

In the 1982/83 sport fishing season, approximately 315,000 resident and 81,000 non-resident angling licences were sold, reflecting a threefold increase in angling demand over the last 20 years and emphasizing the need to improve our fisheries resource. The primary objective of the fisheries program is to protect, maintain, and enhance our native freshwater fish stocks by protecting and rehabilitating fish habitat, introducing hatchery fish, and imposing angling regulations to limit catch.

Hatchery fish introductions help to enhance wild fish populations that are severely depleted. This year approximately 9 million fish (trout, char, and kokanee) were released into 780 lakes and streams throughout the province. In addition, 18 million eggs were collected for incubation and rearing at provincial fish hatcheries. With the completion of the Vancouver Island Hatchery in Duncan, there are now six provincial hatcheries in British Columbia, as well as numerous off-site incubation and rearing facilities.

SALMONID ENHANCEMENT PROGRAM

Since the inception of S.E.P. in 1977, steelhead and sea-run cutthroat trout stocks have been closely assessed in coastal areas of the province. Regular activities include snorkel surveys, creel surveys, adult and juvenile marking programs, stream habitat surveys, smolt enumeration, commercial fishery sampling, habitat capability assessment, life history interpretation, and catch data analysis.

Efforts have also been underway to increase fish production through fry and smolt plants in various streams. In 1982, 38 waters in coastal areas of the province were stocked with 662,000 steelhead fry and 706,000 steelhead smolts. Adult returns from these releases will occur through the period 1985/88.

Cutthroat trout production included releases of 39,000 smolts into Vancouver Island streams, and 50,000 fry and 46,000 smolts into Lower Mainland streams.

Assessment of growth, survival, and abundance of steelhead fry and parr was conducted on numerous stream systems, as well as habitat surveys to determine stream habitat improvement potential.

Research was continued to determine the feasibility of increasing fish production by stocking headwaters with fry, fertilizing streams to increase fish food abundance, installing stream flow control devices, and rearing fry to smolt size in net pens.

Indications are that Bulkley River steelhead are intercepted in the salmon gillnet fishery at the mouth of the Skeena River, so a detailed study was initiated in 1982 which involved radio-tagging and spaghetti-tagging Bulkley River steelhead as well as conducting a creel survey of angler catch.

STEELHEAD HARVEST

Information compiled from the Steelhead Harvest Questionnaire (1982/83) indicated that an estimated 14,475 anglers spent 149,195 days fishing for steelhead in British Columbia. Of these, 7,686 anglers caught a total of 74,109 fish; the highest catch on record. An estimated 82% of all steelhead caught were reported to have been released.

Inland Fisheries Management

Inland fisheries management is directed towards protecting and enhancing our inland (non-anadromous) sport fish populations to meet angler demands.

The annual stocking of many lakes with fingerlings and catchable size

rainbow trout is a major function of the provincial hatchery inland fisheries program. In 1982, 5.8 million rainbow trout were released in 519 lakes. In addition, 1.65 million brook trout, Dolly Varden, and kokanee were released into 93 lakes and streams. The Peace Canyon Hatchery, which opened in 1981, released its first yearling rainbow trout (16,000 fish) into Dinosaur Lake in the spring of 1982.

Research continued to test the effectiveness of aerating lakes to increase oxygen levels during the winter, thus improving the over-winter survival of rainbow trout.

In the Kootenays, B.C. Hydro funded the construction of a mini-hatchery at Hill Creek as mitigation for the Revelstoke Dam. An anticipated 40,000 Dolly Varden and 10,000 rainbow trout will be reared to yearling size at this facility commencing in 1984. Fisheries staff planted 2 million kokanee eggs in Hill Creek and an additional 1/2 million eggs in Inonoaklin River.

Beaver dam removal in the Burns Lake area, and spawning gravel placement in the inlet stream of Kager Lake and outlet stream of Helene Lake were done to enhance local rainbow trout stocks.

The illegal introduction of coarse fish into Jimmy Lake, in the Kamloops area, necessitated poisoning the lake in 1982 to eradicate all fish. Stocking of rainbow trout in 1983 would restore the fishery.

Proposals were prepared for the summer aeration of selected nutrient-rich eutrophic lakes on southern Vancouver Island to increase trout production by increasing water oxygen levels.

Inventory of kokanee shoal spawning habitat on Quesnel Lake was undertaken to evaluate the potential impact of proposed logging booms.

Other functions of inland fisheries management included lake inventories, limnology, fish sampling, creel census, and examination of tributary streams for spawning and rearing potential to provide an index of productivity.

Habitat Management Section

OLD GROWTH FOREST STUDY

An old growth forest study was a major undertaking conducted in cooperation with the Ministry of Forests. The study was designed to analyze five options for the harvesting of old growth timber in Tree Farm Licences 37 and 39. This timber type, 200 to 300 years old, is vital for the survival of healthy deer populations on northern Vancouver Island. The study has been completed and released to the public and the forest industry. With their various comments as the basis for a redraft, the report will be rewritten and presented to Cabinet. Selection of one of five options by the Cabinet will mark the end of the project.

KEMANO COMPLETION PROJECT

The Habitat Management Section has been responsible for coordination of the Ministry's review of Alcan's Kemano Completion Project. Alcan has presented flows for the Nechako, Nanika and Morice Rivers which they contend will protect the fisheries resource. However, these flows are still being assessed by fisheries specialists to determine their impact upon the Ministry of Environment management mandates.

LAND ADMINISTRATION

Financial support from the National Second Century Fund of British Columbia was continued through 1982/83. Long-term management rights (99 years) were acquired by lease agreements on six sites, totalling approximately 165 hectares. Habitat protection for a variety of upland species was achieved via their purchases.

Negotiations for acquisition of numerous other sites were begun during the year. An agreement was completed with Cominco Ltd. granting the ministry rights to manage habitat and create public access on a large area owned by the company in the Highland Valley.

EXPERT WITNESS TRAINING

Habitat Management provided expertise and organizational help in the training of experts to serve in

pollution prosecutions. Courses were held in cooperation with the federal Department of Fisheries and Oceans. About a dozen regional staff were trained in this specialized field.

MINING INTERACTIONS

The Habitat Management Section was involved in the review of environmental impact reports for a number of metal mines, coal mines, and petrochemical facilities. The section also chaired a provincial-federal technical committee set up to review environmental regulation of the placer mining industry.

Agreement was reached with Bethlehem Copper Corporation and Valley Copper Mines Ltd. for the companies to provide compensation of $250,000 for the loss of three lakes in the Highland Valley resulting from a copper mining operation.

CARNATION CREEK STUDY

The ten-year Carnation Creek intensive research project is nearing completion. Preliminary results relating to the impacts of logging operations on stream productivity will be used in an upcoming Carnation Creek Workshop set up to revise environmental protection guidelines for coastal logging in the light of current research.

PESTICIDE PERMIT REFERRALS

Over 350 applications for pesticide use on public lands were reviewed by the Habitat Management Section as a member of the Pesticide Control Committee. Review included pre-treatment inspections on-site, followed by recommendations to the Pesticide Control Branch. Inter-Branch liaison continues, primarily with the Ministry of Forests, on pesticide related issues.

POWER GENERATION PROPOSALS

The Habitat Management Section has been actively involved in the ministry's review of a number of proposed power generation projects. In addition to the Kemano Completion Project, these include the Site C Hydroelectric Project, the Kootenay Diversion Project, and Hat Creek Thermal Generation Proposal.

FISH/FORESTRY INTERACTION PROGRAM

A five-year intensive research project, sponsored by the Ministry of Environment, Ministry of Forests, and federal Department of Fisheries and Oceans, entered its third year. The purpose is to assess and document the impact of landslides on stream environment, fisheries, and forest resources on the Queen Charlotte Islands.

Public Conservation Assistance Fund

The Public Conservation Assistance Fund ($50,000 annually) assisted 14 conservation projects. The Fund provides half the total cost, with project volunteers supplying materials, equipment, labour or additional financing of equivalent value.

Habitat Conservation Fund

A variety of activities were initiated under the auspices of the Habitat Conservation Fund. This fund wass established to acquire and enhance key areas of fish and wildlife habitat in British Columbia.

HABITAT ACQUISITION ACCOUNT

Money for the purchase of land was provided by the Crown Land Fund, which is fed by the proceeds from the sale and development of Crown land. A property comprising 112 hectares was purchased at Hanceville in the Cariboo for its unusual source of quality water. The acquisition permitted construction of a mini-hatchery for rainbow and steelhead.

HABITAT ENHANCEMENT ACCOUNT

The $3 surcharge on angling, hunting, trapping and guiding licences resulted in revenue totalling $1,395,910. Twenty-eight habitat enhancement projects, including ten new ones, were completed at a cost of $730,498, and an advance of $711,801 used to complete projects in 1981/82 was repaid.

Habitat enhancement projects are designed to improve natural ecosystems with the goal of increasing the abundance and diversity of native species.

Aquatic habitats for fish are enhanced by:

- providing spawning areas through

construction of artificial spawning channels or placement of clean spawning gravels in natural streams or lakes;
- increasing juvenile rearing area and access for adult migration by removal of instream debris and log jams, the construction of fishways and fish ladders, and planting of streamside vegetation
- installation of lake aeration mechanisms to promote over-winter survival of fish;
- chemical removal of coarse fish in conjunction with restocking programs to rehabilitate sports fisheries in selected lakes.

Wildlife habitat is enhanced by techniques such as:

- prescribed fire, mechanical thinning of overstory and dead-fall, grass seeding, fertilization, and propagation of preferred browse species to rejuvenate winter range for wild ungulates;
- development of wetlands by installation of water control facilities, dyking, creation of islands and shallow water bodies, maintenance of short-grass feeding pastures, cultivation of transplanted marsh vegetation, and provision of nesting sites to benefit upland gamebirds and waterfowl.

COMPENSATION DONATION ACCOUNT

A new account was established in the Habitat Conservation Fund with the signing of an agreement with the Copper Division, Cominco Ltd. Cominco agreed to provide $250,000 to make up for the eventual loss of fish and wildlife habitat and recreational opportunities on three lakes near Logan Lake that are to be impacted by mining activities. This new account was set up to accept donations from corporations or individuals who agree to compensate the province for the impacts of their developments on fish and wildlife resources.

Marine Resources Program

This program encompasses responsibility for management of oyster and marine plant resources, licencing fish buyers and processing plants and regulating the sale and handling of commmercial fish in British Columbia. In these respects the program serves an economic development and management role through administration of the provincial Fisheries Act and the Fish Inspection Act; the Marine Resources Branch administers these acts and represents provincial interests in the commercial fishing industry. To this end officials represent the province at all international fisheries and boundary negotiations that affect the viability of the B.C. industry.

PRINCIPAL GOALS

1. To maintain and expand employment and profit opportunities for British Columbians through the utilization of finfish resources and the management of marine plant and cultured shellfish resources.
2. To influence the formulation, direction and application of federal fisheries policy for the benefit of the B.C. commercial fishing industry and to similarly influence relevant provincial policies.
3. To ensure that the fish processing, buying and fish-transporting sector operates in a manner which produces a quality product consistent with the regulations of the Fish Inspection Act.

PRINCIPAL OBJECTIVES

Licencing Section

1. To provide a level of enforcement and inspection sufficient to protect consumers, resources, and ensure accuracy of recording and reporting of all sales of fish.

Finfish Policy and Resource Development Section

1. To expand access to resources through advantageous placement of new International Maritime Boundaries and to support positions advantages to the B.C. industry in west coast international fisheries negotiations.
2. To develop a system of Coastal Zone Management that will foster the development of mariculture, and ensure the compatibility of economic development and recreational use with protection of habitat of renewable marine resources.
3. To improve value added to processing and utilization of product.
4. To collect, analyze and distribute statistics of current production.

Shellfish Management and Development Section

1. To increase and diversify oyster culture production.
2. To diversify shellfish culture (scallops, mussels, abalone) through research and development of technologies.
3. To protect and manage oyster culture and wild oyster habitat.
4. To create a favourable investment climate for the maintenance and expansion of the shellfish culture industry through policy development and implementation and through provision of advice to both private and public institutions.

Marine Plant Management and Development Section

1. To develop kelp management and edible seaweed resource management plans that will sustain kelp meal, edible seaweed, and alginate extraction industries.
2. To ensure that all seaweed harvesting operations are appropriately regulated through issuance of harvest licences.
3. To accommodate the special interests of Indian people in the issuance of commercial seaweed harvesting licences.
4. To create a favourable investment climate for the development of a

seaweed industry in B.C. through implementation of harvest strategies compatible with other renewable resource uses.

5. To provide public information and education material in cooperation with the Information Services Branch on the use and protection of both wild and cultured commercial and recreational renewable marine resources.

Inspection, Licencing and Enforcement Section

A new licence format and fee structure received approval and went into effect in 1982. Each licence issued is now validated with a decal for the appropriate category. 205 processing plant licences and 386 category validating decals were issued. For comparison, the 386 decals correspond to the previous year's licences, which numbered 364 - an increase of six percent. Future annual figures should indicate trends in the industry and will give a more accurate breakdown of the processing sector by species class.

Sport caught cannery licences numbered 2 - down from the previous year figure of 3. Commercial salmon cannery licences issued remained at 19; however production was 55% below that of 1981. Fish buying station licences issued numbered 546 with the attendant number of decals being 806. This is a decline of 9% from 595 in 1981. This new licence format will also indicate industry trends in the buying sector, governed by either value or resource availability or both.

New licencing in the form of the Fisherman's Vending Licence was introduced and 345 were issued. This licence is required by fishermen selling their own catch directly to a consumer or retail outlet only. The practice appears to be gaining in popularity. The licence is intended as an instrument to ensure more accurate records of resource catch and sales distribution.

Ongoing activities were also directed toward illegal processing and buying; monitoring sources and sale and bivalve shellfish; advising industry toward creating new or upgrading existing facilities as required; and promoting quality and consumer protection in fish products.

Several prosecutions were made for illegal canning of salmon destined for commercial sales. These operations constituted a very serious threat to the consuming public and the well being of markets and employment.

Finfish Policy and Resource Development Section

INTERNATIONAL FISHERIES NEGOTIATIONS

Provincial interests were represented at negotiations between Canada and the United States to limit and coordinate their interceptions of salmon. Marine Resources Branch staff supported the trend of the negotiations and developed clauses which will include steelhead in the agreement, and supported those which will ensure that British Columbia fishermen are entitled to a catch of salmon commensurate with the value of salmon produced in British Columbia waters.

A long-term agreement was negotiated for Canada and the United States. However, a treaty has not been ratified. The senior governments continue to discuss changes to the document.

Similar support and initiative was provided by the province to protect both B.C. salmon and steelhead from capture in the North Pacific, outside of the 200 mile limit.

FISHERIES POLICY AND RESOURCE DEVELOPMNET

Federal advisory committee meetings were attended in order to analyse and interpret federal policies.

The fish buyer and processor licence system is being monitored to reflect the existing activities in the industry and to provide reliable information to assist in provincial policy implementation. Analyses of this sector are in progress with the objective of developing provincial policies which will assist in stabilizing the industry to maintain the existing level of employment and assure the long-term economic viability of the industry.

The role of fish buyers in the industry has been the primary focus during the past year.

FISHERIES STATISTICS

The transfer of responsibility for the collection and dissemination of processed product production statistics from the Department of Fisheries and Oceans to the Marine Resources Branch was completed. This section publishes the Annual Production Statistics Report, the Fish Freezings Report and the Canned Salmon Report.

FISH PROCESSING TECHNOLOGY

A joint project was funded with the Technology Services Branch of the federal government to hold shrimp in chilled seawater. An improved seawater chilling system will increase the storage life and thereby increase the value of shrimp and prawns. Engineering models were developed to the pilot scale stage.

MARICULTURE DEVELOPMENT

Joint research between the Marine Resources Branch and the federal Resource Services Branch was undertaken to develop the commercial potential of rainbow trout reared in seawater. The primary objectives are to increase the economic viability of trout farming in seawater through practices to reduce mortalities from disease (nephrocalcinosis), the formulation of low-cost diets, the development of hybrids, and the development of unisexual stocks to prevent the occurrence of precocious males. The studies have been successful and some results are now being transferred to private industry.

A consultant was contracted to determine the market for farmed salmonids in B.C. The market potentials were characterized by segment, price, and product type. This will be of prime importance in assisting in the management of the salmonid farming industry.

COASTAL ZONE MANAGEMENT

The concept of coastal zone management is becoming of paramount importance as the competition for use of British Columbia's foreshore areas increases. Staff have initiated a mapping system which will enable the establishment of priority use areas for the mariculture industry. The long-term result will be the establishment of mariculture reserves along the coast which can be protected from perturbations by other industry and recreational uses. This system will in turn protect non-mariculturists from the encroachment of mariculture operations and concentrate the need for environmental surveillance.

Shellfish Management and Development Section

SHELLFISH INDUSTRY DEVELOPMENT

This year continued the trend of increasing interest in shellfish culture. The number of registered oyster growers increased from 117 to 143 which represents an increase of 22%. Similarly acreage under cultivation increased by 539 acres to 3,339 acres or 16%. In the past five years from 1977 to 1982 the number of registered growers has risen from 65 to 143 or by 120%.

The longline culture feasibility study has entered the final phase with harvesting and processing underway. The condition of the oysters has been very good overall, despite heavy fouling at some sites. The final report will be able to make specific recommendations about the technology of longline oyster culture and harvesting.

Due to the concern over water quality expressed by the Ladysmith growers, a small test culture experiment was established in the Harbour to determine if quality oysters could still be cultured from seed on the inner leases of Ladysmith Harbour. Five culture techniques will be compared in the Harbour along with a control plot in the outer Harbour.

The scallop culture feasibility project is continuing in cooperation with the Nanaimo Biological Station, and Japanese scallops have been imported and held in quarantine to be used for seed production. Scallops from the Canadian east coast have also been imported for similar trials. To date there has been limited success in obtaining good survival of larvae; this probably reflects unfamiliarity with the techniques, and survival is expected to improve.

This has been the final year of the mussel culture work and the report is being written. This work has indicated that mussel culture in British

Columbia faces two significant problems; the most important is unexplained mass mortalities in maturing cultured stock, and heavy predation from diving ducks. Some work is being undertaken by the private sector to identify the cause of these "summer mortalities."

EXTENSION AND LIAISON

The Newsletter continues to be a valuable communications organ, and continues to engender a most positive reaction. It is now into the third volume, with issues 1 and 2 already having been sent out. This newsletter now has a mailing list which includes several foreign countries.

This year for the first time extension workshops were put on for oyster growers, where technical staff organized a series of "hands on" workshops to help educate new and existing growers in the basics of oyster culture. The concept was enthusiastically endorsed by the attendees and further workshops are planned.

A cost and profitability study has been initiated in order to provide growers with some basis for estimating costs, profit and cash flow for various types of culture.

SPATFALL MONITORING

This year no commercial set was recorded in Pipestem Inlet, and only a light commercial set in early July occurred in Pendrell Sound. Several growers experimented this year with remote setting of eyed larvae using a publication which provides a "code book" description of the do's and don'ts of this new technology.

HABITAT PROTECTION

Good progress was made in developing a new "Mariculture Land Disposition" policy with the Ministry of Lands, Parks and Housing, and the framework for an inter-Ministry management agreement.

The Meares Island planning task force met numerous times this year bringing together all the information and groups pertaining to the planning process. A final plan report is expected in 1983.

Several large natural gas developments were reviewed for their impacts on shellfish habitat and growing areas.

Eighty habitat referrals were processed this year, the majority coming from the Ministry of Lands, Parks and Housing and the Waste Management Branch.

PUBLICATIONS

The following publications were produced in 1982:

Jones, Bruce and Gordon, 1982. Methods for Setting Hatchery Produced Oyster Larvae, Marine Resources Branch, Information Report #4. 61 pages.

Turner, K. C. and Morris, R. L., 1982. An Investigation of Bacterial Contamination Entering Patricia Bay and Mill Bay, Saanich Inlet. Marine Resources Branch. Fisheries Development Report #31. 99 pages.

Clayton, W. E. L. and Cox, R. K., 1982. 1981 Pacific Oyster Breeding Pendrell Sound. Marine Resources Branch - awaiting publication.

B. C. Shellfish Mariculture Newletter. Volume II numbers 1-5. 81 pages. Total copies produced 1,650.

Are the Shellfish in Your Area Safe to Eat? Brochure. (Pobran, T.)

Marine Plant Management and Development Section

KELP MEAL DEVELOPMENT

Surveys were carried out to update inventory data for both Port Hardy and Porcher Island areas in anticipation of industrial activity. Enmar Resources Corporation submitted a new proposal calling for a quota of only 2,000 wet tonnes to be harvested in the Port Hardy area.

KELP HARVESTING: HERRING SPAWN-ON-KELP INDUSTRY

Almost 100 tonnes of the giant kelp Macrocystis were harvested by 26 herring spawn-on-kelp operators in 1982; over half of the total was taken in the southeast Queen Charlotte Islands and Port Hardy areas. Wholesale value of export product was $3.86 million.

KOMBU (EDIBLE KELP) DEVELOPMENT

Control and commercially harvested plots were examined to determine impacts of harvesting on recruitment. Two years after harvest Laminaria covered only 50% of preharvest levels while Cymathere had fully recovered. Several groups are investigating market prospects and carrying out product development and promotion for both wild and cultured kombu products.

British Columbia's first commercial seaweed culture operation got underway in 1982 with a small farm being established in Barkley Sound.

Waste Management Program

Prior to September 1982, the Waste Management Program was adminis-tered by the Director of Pollution Control under the authority of the Pollution Control Act and the Litter Act. In September the new Waste Management Act was proclaimed in part and the Pollution Control Act was repealed. Those sections of the Waste Management Act pertaining to litter have not been proclaimed and the Litter Act remains in force. The former Director of Pollution Control was appointed as the Director of Waste Management.

The goal of the Waste Management Program is to manage the discharge of waste materials from municipal and industrial sources for the protection of the environment and for the conservation of resources. The program's objectives are:

1. To regulate discharges of waste so as to control pollution of the environment of British Columbia for the benefit of people, wildlife and fish.
2. To maintain an inventory network and data bank on waste discharges and environmental quality to assist surveillance functions and enable planning activities.
3. To assist in the development and implementation of planning strategies for the management of the environment.
4. To safeguard the environment from hazardous materials by cleanup of spills and by the development and administration of programs designed to prevent and respond to spill incidents.
5. To inventory, assess and classify materials now being wasted and to develop and implement plans, procedures, practices and programs for alternative uses or control of these materials where possible.
6. To initiate and research into problems associated with waste discharges and to undertake special studies and investigations on the impact of materials, products and wastes on the environment.
7. To provide education and information respecting waste materials and environmental quality.

During the year decentralization of staff and authority to the regions was finalized.

In carrying out its mandate, the Waste Management program issued or amended 381 waste management permits during the fiscal year leaving a total of 3,283 active air, effluent and refuse permits in the various regions of the province.

In accordance with the Auditor General's report, a Program Evaluation team was formed with a view to review the performance of the various groups in the Waste Management Program. This group has made considerable progress in ensuring a uniform delivery of the program.

Technical Services Section

The new Waste Management Act no longer contains provisions for branch review of sewerage collection systems. This results in a saving of three man years of engineering effort and a redeployment of staff to other duties.

Victoria staff have now almost completed the backlog of major projects which have been under review. The City of Kamloops sewage treatment lagoons will undergo a major renovation to ensure that phosphorus which serves as a nutrient for aquatic vegetation will not be released to the Thompson River system in the critical low flow winter period. The Town of Merritt will also restrict the direct discharge of phosphorus to Coldwater-Nicola River system during the critical low flow period.

The facilities serving the resort municipality of Whistler have caused some problems in recent years owing to weekend overloading of the treatment facilities. Flow balancing tanks will be added this year and phosphorus removal will commence. Environmental

studies will be carried out to assist planning for minimizing the environmental impact of future growth.

Ministry staff, together with those of other agencies, undertook an initial conceptual study of redirecting the effluent from the Greater Vancouver Sewerage and Drainage District Iona sewage treatment plant from the Sturgeon Bank to deeper water offshore. The GVS&DD are presently completing environmental studies prior to a final proposal expected in late 1983.

The new Waste Management Act allows municipal governments, at their option, to prepare a waste disposal plan for ministerial approval. This is intended to assist long-term planning with full public review in the formative stages. Some 22 lower Fraser Valley municipalities and regional districts have indicated their intention to deal with their million-ton annual solid waste disposal problem in this manner. The plan is expected to take several years to formulate.

With the passage of the new Waste Management Act in September, it has been possible for permittees to ask for temporary relief, through a ministerial Variance Order, from those obligations in a permit which they are unable to meet. Some fifteen plants had made application during the last five months of the fiscal period. These included a remote sawmill, pulpmills, mines, smelters and even a municipality.

The Buttle Lake-Westmin project was very active during the year. A number of steps were taken, including the diversion of runoff water away from the old waste rock pile where most of the contamination is originating. Tests to develop land tailings disposal continue. One novel idea is the injection of tailings into the waste rock pile to seal it off.

The control of cyanide in the Carolin Mines tailings continued to receive much attention. A mild winter and a heavy January rain combined with a lack of adequate alkaline chlorination treatment capacity created a serious impoundment problem. Production was stopped while the impoundment dam was strengthened and pond supernatent was treated and recycled until the cyanide level could be reduced to the point that an acceptable discharge quality was achieved.

Amax mines at Kitsault closed down for the winter because of market conditions and Afton Mines only operated for a few months. Both of these operations have been controversial.

A number of the other major mines have closed down indefinitely. These included Noranda Bell, Granisle, Boss Mountain, Endako and Northair.

Fording Coal and B C Coal interrupted production for several weeks at a time to reduce inventory. Crows Nest Resources at Elkford went into production at 1 1/2 million tons of clean coal. Quintette and Bullmoose in the northeast coal block are under construction. Quinsam Coal, on Vancouver Island, has had its Stage II study accepted in principle.

There have been no major developments in the manufacturing section.

Gulf Canada announced closure of its refinery at Kamloops.

Construction on the Ridley Island port facilities near Prince Rupert continued throughout the period.

The forest products industry has also felt the full impact of the recession with all pulpmills closing for varying periods of time to reduce inventory. Many pollution control programs have been postponed.

The new Quesnel River Thermal-Mechanical pulp mill has had difficulty meeting permit toxicity requirements. In order to meet product specifications, it has had to add sodium sulphite which has adversely affected treatment even further. Studies are being carried out to find a solution.

Environmental Safety Program

The Waste Management Branch's Environmental Safety Program coordinates B.C,'s programs for special wastes, wastes which are potentially hazardous to human health and/or the environment, and which require special management technologies. It also carries out spill response and prevention activities in conjunction with the Ministry's Provincial Emergency Program.

Following a call in early 1982

for competitive proposals from the private sector for the management of special wastes in the province, nine companies submitted detailed plans. An inter-ministry assessment committee examined each proposal extensively in terms of environmental impact, technical capability, project scheduling, financial and corporate capabilities, and other socio-economic factors. It subsequently produced a short list of four proponents: Browning-Ferries Industries Ltd., Chem-Security Ltd., Genstar Conservation Systems/IT Corporation, and Stablex (Canada) Ltd. and these firms were interviewed in late November.

The Environmental Safety Program also participated in a comprehensive program to identify potential secure landfill sites for special wastes. By eliminating areas of the province which did not meet a variety of technical and land use criteria, 11 sites were identified as candidates for field investigation.

Regional Special Waste Storage Facilities located in Kamloops, Nanaimo, Prince George, Surrey, and Victoria provided an important service by receiving waste household, educational, agricultural and pharmaceutical chemicals. During this period, 146 large drums of these materials were shipped to licensed disposal sites in the United States.

From April 1, 1982, to March 31, 1983, approximately 483 reports of spills of dangerous goods and special wastes were received. The discharge of cyanide containing effluent from a mining operation into Ladner Creek, and a spill of sodium chloride along a major portion of Highway 97 were particularly significant.

Resource Recovery

The primary role of the Resource Recovery Section is to achieve the diversion of wastes from the garbage and litter streams in favour of re-utilizing the materials that would otherwise be wasted. Each year, over one million tonnes of municipal garbage is buried in landfills in the province with a small but growing percentage being usefully recovered. In addition to reducing the impact to the environment of such large scale disposal, resource recovery contributes to pollution control and savings in energy and virgin materials.

One role is to inform and educate the public and a current public opinion survey indicates that nearly two-thirds of the householders in British Columbia now support recycling and over half support such programs being mandatory. A seminar was arranged at which various municipalities explained initiatives they were pursuing to promote recycling so that others could best determine how to proceed in the future. An education kit for secondary schools on the concepts of managing wastes and recovering resources is near completion.

Another essential role is the improvement of markets for recovered materials. Research indicates there is a strong potential for the use of shredded tires as a supplementary fuel in industry. A workshop on this topic was attended by representatives from various industries and other groups. Trial applications have since been undertaken at a pulp mill and an examination of burning tires in cement kilns is in hand and appears most promising.

The Oil Save program is directed at those who change their car oil at home; about half of all car owners. There are now some 500 gas stations who will accept such oil. Many of their owners give the proceeds from the sale of the oil to the Variety Club to benefit handicapped children. A major re-refining facility in the Lower Mainland area has started a further phase of operation with a capacity of one million gallons per annum. This program, therefore, protects the environment, ensures the beneficial re-use of the most valuable fraction of the oil stream, and helps to finance an essential charity.

Continued attention has been given to enhancing the market for crushed glass potentially recoverable from the 70 million wine and spirit bottles used annually in the province, and from other glass containers. Following the successful workshop last year, Domglas Ltd. in Richmond, are now accepting contaminated glass to be

cleaned by a mobile benefication plant from time to time. They have also agreed to accept a proportion of mixed-colour glass. These two measures should be a major boost to plans to divert such glass from landfills.

A study is being made of a scheme for hygenic bottle washing and re-use, primarily for promotion with the wine producers in the interior of the Province.

Materials recycling constitutes one of five objectives established by the Greater Vancouver Regional District to control the disposal of refuse. The branch is represented on the committee which is addressing this issue, together with members from various local industry and recycling groups. The ministry is leading a team preparing a waste management plan for the lower mainland and the work of this committee will comprise one essential input. The branch has been developing a data collection system to provide an information exchange on a province-wide basis.

Regulations are being prepared under the new Waste Management Act to replace the "bottle refund" provisions in the old Litter Act. The thirty or more uses made for every one of the 500 million beer sales indicates the importance of this complex issue.

Regulations to promote the use of sludge on land have been drafted.

VANCOUVER ISLAND REGION

The regional office maintains a regularly updated information base on the compliance status of its permits. Permit inspection schedules are being followed and adjusted as necessary.

Three pulp mills requested variance orders under Section 13 of the Waste Management Act to defer the installation of major pollution control facilities, because of economic considerations. No decisions have been made with regard to the granting of these requests.

Stage II approval was given to Westmin for the proposed mine/mill expansion, and applications relative to this expansion are presently being assessed by regional staff.

Similarly, Stage II approval (conditional) was granted to Quinsam Coal Ltd. concerning a proposed open pit coal mining operation near Campbell River. The regional office has been involved directly with the proponent to develop an acceptable baseline, construction and operational monitoring program, as well as an environmental supervision and surveillance strategy.

The Environmental Safety Program investigated approximately 24 spill incidents, mostly of oil related products. Ten major industrial operations were contacted about the preparation of spill contingency plans. Hazardous chemical pick up, packing and disposal continues to be a major program function. A new ESP chemical storage building in Victoria is nearly completed.

Negotations are continuing with major municipalities and regional districts regarding permit compliance and upgrading of pollution control facilities.

A limited ambient air monitoring program continues to be operated in the region.

A procedure has been developed in conjunction with the Environmental Laboratory in order to audit the continuous TRS analysers used by the pulp mills in Region 1. The mills have been advised to install the necessary valving, and the auditing procedure should be implemented during the next fiscal year.

Permittee stack sampling techniques are witnessed on a regular basis by regional staff. This witnessing procedure involves the pulp mills, larger sawmills and consultants operating in the region.

Major pollution control works are being constructed for the Crown Zellerbach mill in Campbell River, and the Tahsis Co. mill in Gold River. This equipment should be operational next year.

LOWER MAINLAND REGION

Improvement in the permit compliance levels was a major priority during the year. Significant gains were made towards that goal, increasing the compliance from 48% at the beginning of the year to 69% at the end of the year.

Permit processing was gradually

transferred to the region during the year. At year end 78 applications were outstanding in the region.

A total of 85 hazardous spills were reported to this office during the year. Carolin Mines cyanide laden effluent spill, North American Scientific warehouse fire, Dow Chemical toluene spill and Trans Mountain Pipeline sour crude incident required significant manpower and laboratory resources. Carolin Mines' spill resulted in extensive follow-up with regular 24-hour sampling and accounted for a major portion of regional manpower needs.

A total of 92 barrels of special waste was received in the region.

The Enforcement Team conducted 105 legal investigations, which resulted in 4 prosecutions and 17 orders being issued by the region.

The acute problem of refuse disposal in the lower mainland resulted in initial steps being taken towards the development of a Waste Management Plan for refuse for G.V.R.D., the Central Fraser Valley Regional District and the Dewdney Alouette Regional District.

Seventeen environmental impact studies were undertaken. The Fraser River water quality monitoring study was completed and a report is currently under preparation.

The data gathering phase of storm-water monitoring project was underway. A report on the project is expected late in fiscal 1983-84.

Burrard Inlet task force was struck within the Waste Management regional operations to control the problem of unauthorized discharges identified by the Enforcement Team. Action has been formulated for each of the discharges and implementation will be during fiscal 1983-84.

Significant work was done towards controlling suspended solids discharges from gravel operations in the Coquitlam River.

THOMPSON-NICOLA REGION

The Nicola Basin Strategic Plan was completed and, as a result of the identification of data gaps in specific watersheds, the upper Nicola Basin Study has been initiated.

Regional input to the Thompson-Bonaparte Strategic Plan with regard to water quality, lake and effluent monitoring, existing permits and non-point source discharges was completed.

The Clinton Creek report, completed last year, was presented to the Village of Clinton Council with a request to consider the removal of the domestic effluent outfall from Clinton Creek.

Approximately 800 individual items were received during the fiscal year at the hazardous waste storage facility located in Kamloops. On November 2, 1982, a shipment of 68 45 gallon drums was made to a disposal site near Arlington, Oregon.

The Regional District of Columbia-Shuswap agreed to proceed with the improvement of maintenance at its six refuse sites to meet the requirements of its permits. Improvements are to be effected by the letting of a maintenance contract.

The City of Merritt agreed to remove its treated domestic effluent discharge from the Nicola River during the low water period of fall and winter and, instead, dispose of it in rapid infiltration beds.

An agreement was achieved between Waste Management staff and the local Health Branch personnel regarding the requirements for the disposal of sewage for operations which, through expansion, may come under the jurisdiction of the Waste Management Act some time in the future.

The Village of Cache Creek agreed to investigate the options for the disposal of treated sewage effluent by ground disposal in an effort to remove their discharge from the Bonaparte River. A contract for the evaluation of soil conditions to determine the potential for rapid infiltration is underway.

The maintenance of climatology stations in the Nicola, Dewdrop and Savona areas and the maintenance of solar radiation equipment at the Agriculture Canada Farm in Kamloops was taken over from Air Studies Branch personnel.

The upgrading of the Kamloops ambient air monitoring network to provide instantaneous readout at the Ministry of Environment offices in Kamloops was 75% completed.

KOOTENAY REGION

Significant progress has been made in the reduction of the number of permits in non-compliance. This program has resulted in one successful prosecution during the fiscal year with four more planned or in progress. It is anticipated that further non-compliance problems will be resolved by October, 1983.

The trend towards regionalized refuse disposal is gaining momentum in the Kootenays. Three sites have been closed in the Nelson area with refuse now being disposed of in a regional Level A site. In the East Kootenays a program to replace 16 municipal refuse sites with three Level A regional sites is well underway. The use of regionalized sites facilitates improved levels of operation and will result in a significant decrease in the environmental impact of refuse disposal in the Kootenays.

Environmental monitoring was directed towards continuation of the Elk River nutrient study, completion of a productivity analysis of Tie Lake and implementation of a nutrient balanced investigation of Windermere Lake.

Involvement in planning activities has increased, with major contributions to the development of the Elk Valley and Upper Columbia Strategic Plans, as well as the Slocan Valley Plan. With the passage of the Waste Management Act, municipalities are being encouraged and assisted in the development of waste management plans for refuse and sewage disposal.

Since the passage of the Waste Management Act the Minister has issued variances to two major operations in the Kootenay Region, granting relief from some of their permit requirements.

The need for a proper hazardous chemical storage facility in Nelson remains critical. B.C.B.C. have chosen a site for the proposed storage facility and construction is scheduled for August, 1983.

CARIBOO REGION

No serious environmental problems occurred or were identified during the year. With the increased staff resulting from establishment of the regional office, effective permit administration increased with permit amendments to reflect the needs of the environment as well as actual permittee situations.

Negotiations were begun for a pulpmill in Quesnel to treat the sewage from the City of Quesnel and an outlying area (Red Bluff) in its treatment lagoons. The treatment plant operating and capital cost savings are substantial.

The sawmills in Williams Lake have submitted proposals for upgrading their burners to alleviate the smoke and flyash problems in the city.

After many meetings and negotiations with Federal Fisheries and the Environmental Protection Service and company personnel, an agreement was made for a joint treatability study on the effluent from the new thermomechanical/chemithermomechanical pulp mill in Quesnel. The approved five-day aeration basin had proven incapable of detoxifing the pulp mill effluent.

A serious black liquor spill at a kraft mill in Quesnel in late October was adequately treated (detoxified) in the lagoons but resulted in an investigation that identified two areas in the mill where excessive losses were occurring. The washer system seals have since been repaired and the effluent quality has improved two to three hundred percent.

The Cariboo Regional District completed a Lake Management Strategy Plan to regulate development around lakes and take into account nutrient impact from man's activities. The plan was developed in cooperation with regional Environment staff and a committee, chaired by Waste Management, to classify lakes in accordance with the plan, has been established. Future sampling programs to collect data to aid in classifying the lakes in the region are being planned.

Technical and safety training courses have been offered to the staff during the past fiscal year. In addition, a spill response training session was offered in conjunction with the R.C.M.P. in Williams Lake.

At a large copper open pit mine,

a high copper concentration in the seepage water from waste rock piles was identified. The company has since installed a reclaim system to pump contaminated water back to the closed circuit tailings pond.

The report on nutrient impacts on Kokanee Bay kokanee spawning beds is in the final stages of drafting.

SKEENA REGION

The acid generation problem at Equity Silver Mines was brought under short term control. A public surveillance committee was established to consider the Company's long term options and recommend alternatives. The committee has worked very successfully. Scottie Gold Mine was brought substantially into compliance after new cyanide destruction technology was installed. B.C. Timber was excused from its pollution control upgrading program until 1989 by the Environmental Appeal Board. Interim discharge limits have been negotiated. Sewage treatment facilities at Terrace and Stewart are being upgraded. A compliance and inspection schedule was created and is updated monthly.

The Environmental Section initiated an extensive routine water quality monitoring program in rivers, lakes and marine waters. Receiving environment programs for B.C. Timber, Eurocan, Equity Silver and Bell Copper were reviewed and finalized. Data reports were released on Atlin Lake, Endako Mine, Cassiar Asbestos, Consolidated Cinola, Goosly Lake, the Smithers Lakes Study and Aldrich Lake.

The Environmental Safety Officer began preparing a regional spill contingency plan. Several hundred pounds of hazardous chemicals were received from the public, hospitals, schools, RCMP or municipalities. These materials go to Prince George as no storage facility exists in the region. Twenty spills of chemicals or oils were reported, all were minor.

The regional waste manager and Environmental Section head are still contributing to two working groups of the Yukon River Basin Study.

OMINECA PEACE REGION

The North East Coal Development has been the major issue for Waste Management in this region. The greatest environmental impact has been the silting of three rivers from the BCR tunnel operations. Quintette, with the largest open pit coal mine in Canada, and Bullmoose, should both be in operation shortly. In conjunction with the ministry, the coal companies and port operator have cooperatively implemented a coal dust monitoring program along the rail corridor and at the port.

Four out of the five pulp mills in this region are now operating within our Level A Objectives, while the fifth mill has agreed to implement an upgrading program to achieve Level A by the end of 1989 at the latest.

Most of the municipalities in this region have recently, or are in the process of upgrading their sewage treatment and disposal works. Only the City of Fort St. John and Mackenzie will be facing major upgrading in the near future under the reduced funding formula.

Discussions with Alcan have commenced in regard to a proposed aluminum smelter north of Vanderhoof. Much more involvement from Waste Management is expected during the next fiscal year.

All the three major gas processing plants are now operating within their Waste Management Air Permits for sulphur recovery. The most significant improvement has occurred in the largest plant at Fort Nelson, where the percentage of sulphur recovered has increased from approximately 80% to 95%.

OKANAGAN REGION

The delivery of the Waste Management Program in 1982/83 met target achievement levels in terms of permit processing and permit administration. Permit compliance was, however, slightly less than target.

In the Municipal Section, special problems with irrigation schemes in the Vernon/Armstrong area continue to have priority over other regional problems. The whole question of sewage disposal within the Okanagan watershed is being subjected to review and reassessment. The excellent results of treatment at the Kelowna Bardenpho plant may have a

significant bearing in the development of an overall basin wide waste disposal strategy.

Municipal refuse disposal practices received high priority due to problems in that area.

In the Industrial and Air Section, permit processing efficiency increased; however, due to the backlog and rate of new application filing, delays in the issuance of permits is of concern. Permit surveillance was emphasized in order to reduce non-compliance statistics, but emissions from forest industry operations continue to distort the compliance figures.

The Environmental Safety Program is being improved through construction of a hazardous waste storage building in Penticton.

The Environmental Section, continued its work of assessing the immediate impacts of independent discharges and the accumulated impact of many discharges as well as other cultural influences on Okanagan surface waters.

Water Management Program

The goal of the Water Management Program is to manage the water resources of British Columbia so that the greatest possible economic, social and recreational benefits can be realized by its residents, through reduced flooding and a supply of water which is plentiful and of good quality. This goal is met by:

- allocating and regulating the use and supply of water through a licensing system involving about 35,000 licenses;
- preserving or enhancing the quality of the water resource;
- reducing the potential for loss of life and property damage caused by erosion and flooding;
- ensuring an appropriate level of health engineering and technical standards for water supply systems and regulating privately owned water utilities;
- providing information on the capability of the resource to meet water supply needs and to support aquatic life.

The basic resources utilized in efforts to fulfill the above goal and associated objectives were a staff of 287 and 18 million dollars. The utilization and accomplishments of these resources are described in the sections which follow, presented in terms of the above objectives.

WATER ALLOCATION AND REGULATION

General

The provincial water resource is allocated and its use regulated under a licensing system for maintaining related water rights in respect of individuals, communities and industries.

The office of the Comptroller of Water Rights, which includes the Deputy Comptroller, has overall responsibility for the program in respect of which the regional offices traditionally provide a major and expanding role.

Water Licensing

During the fiscal year under consideration, a total of 1,417 applications for new water licences were received. This compares with 1,751 applications during the previous year. In the same period, 1,562 Conditional Water Licences and 135 Final Water Licences were granted, along with 496 associated permits to occupy Crown land.

As of March 31, 1983 there were 34,520 active Water Licences on record. Of those licences, 891 received consideration for amendment of the rights granted, based on applications filed by the respective licensees, and a further 614 licences were subject to minor forms of amendments to correct errors, re-name sources of water or otherwise alter the licence without changing its terms. The Victoria administrative staff processed 2,681 transfers of licences with ownership or changes of address. The Comptroller received notice of 4 proposals by licensees to expropriate easements in accordance with Section 24 of the Water Act.

The issue of approvals under Section 7 of the Water Act is the responsibility of the regional water managers. A total of 795 such approvals were considered during the period under review.

During the year, 438 new B.C.G.S. water licence maps and 22 reference maps were produced by staff of the Mapping and Drafting Office, also 796 old water rights maps were converted to reproducable mylar material. The new mapping replaced 178 water rights maps, some of which were 60 years old, and 1779 available B.C.G.S. maps currently remain to be processed.

Major licensing accomplishments include the draughting of 1178 water application plans, 1035 amendments, orders and final licence plans, and the plotting of 456 cadastral subdivision plans.

Draughting support for the Community Water Supply Section was initiated during the year and graphics, plans and maps for 44 projects were completed, requiring 53 man-days. A backlog of 89 projects currently remain on hand.

The Power and Special Projects section, which provides specialist technical and advisory support to the Comptroller in licensing matters pertinent to hydro power and other large developments, has maintained continuing involvement in a number of proposed hydro-electric power developments throughout the province, including Site C on the Peace River, the Stikine-Iskut and Liard Projects in northern British Columbia, the Keenleyside-Murphy Projects in the Columbia River System, and the Homathko Project located in the southwest coastal region of the province. In the case of Site C, public hearings under the chairmanship of the British Columbia Utilities Commission were completed and the Commission's recommendations forwarded to Cabinet for review. Technical, environmental, and socioeconomic studies on other major projects were continued but reduced in scope due to a marked reduction in forecast loads, and the resulting postponement of inservice requirement dates in project scheduling.

Implementation of the conditions of the conditional water licence issued in respect of the Revelstoke Hydroelectric Project is largely administered and monitored by staff of the Power and Special Projects Section on behalf of the Comptroller. While the project is scheduled for completion by May, 1984, filling of the reservoir will commence October 1, 1983. The section staff and two specialist consultants continue to assess the engineering aspects of the dam, and staff members chair the Revelstoke Project Co-ordinating Committee and the Revelstoke Project Community Impact Committee which are charged with the continuing review of construction activities as well as environmental and social impacts on nearby communities. Input from regional water management staff and from other branches and ministries has made a major contribution to the operation of these two committees. B. C. Hydro signed an agreement with the government to provide $6 million to fund the Fish and Wildife Compensation/ Stabilization Program at Revelstoke required as conditions of the water licence. In addition to other matters, the Revelstoke Log Transfer Facilities Committee chaired by a staff member has been working out details of a log transfer facilities system at the dam, which would enable logging companies to continue to log the watershed above the dam with minimum economic disbenefit.

A joint British Columbia, Alberta, and B. C. Hydro and Power Authority task force was formed in 1974 to study the Peace River and make recommendations on aspects of reservoir regulation which would mitigate the flooding of communities downstream caused by ice jamming and related phenomena aggravated by the G. M. Shrum power station operation. The task force, under the chairmanship of a Water Management Branch staff member, met twice during the year.

The branch is also represented on a B. C. - Alberta Technical Working Committee reviewing the possible effects of reservoir regulation within B. C. on future hydro-electric projects on the Peace River in Alberta.

There are plans to expand the power plant and construct additional smelters at the Alcan project in Kemano which was authorized in 1950 under the terms of a special agreement and a water licence issued under the Industrial Development Act. Subsequent actions by the federal Minister of Fisheries limited the ability of the company to proceed. The Comptroller was represented by a staff member on a joint technical committee of Alcan, federal government and provincial government representatives which recently reported upon the potential impacts of the proposed expansion, with particular reference to the regulated releases of stored water authorized by the existing water licence. Alcan is now in the preliminary planning phase for an application for an Energy Project Certificate.

Power and Special Projects staff undertook reviews of water licensing requirements and water management assessment for several mining and industrial developments. These

included 10 metal mines; 11 coal mines in the Southeast Kootenay area, the Northeast Coal Block area, and on Vancouver Island; and reports on the Natural Gas Allocation Process for proposed L N G, methane and ethane petrochemical plants. Staff functions also included ongoing membership on the Reclamation Advisory Committee which advises on all mining programs and operates under Section 8 of the Mines Act.

Fees, rentals and other charges are payable to the Crown in respect of applications, licences and other proceedings under the Water Act. During the past fiscal year revenue collected amounted to $191,541,561.98. Of this sum, power rentals produced $188,179,987.60; rentals paid by local authorities for the supply of water for waterworks purpose produced $274,896.05 and for irrigation purpose a further $32,313.54; other rentals produced revenue of $2,735,560.53; and $314,499.36 was collected for application fees and other service charges.

An aggressive rental arrears collection program recovered $9,911.80 in outstanding rentals which otherwise would have been lost to the Crown.

This program also resulted in the cancellation of 150 licences for failure to pay the rental arrears. Another 57 licences were cancelled where the licensee had failed to construct works within the time specified in the licence or failed to make regular beneficial use of the water.

Regulation

The Water Act requires that water licensees install and operate works, and store, divert and use water in accordance with the terms and conditions of their respective licences and with due regard to the prior rights of other water licensees. The regional water managers and engineers appointed under the Water Act regulate the storage, diversion and use of water; and the structural integrity of dams and other works to ensure public safety, the protection of property, the beneficial use of water, and the rights of licensees.

This regulatory function becomes particularly critical during periods of drought, high freshet flows or during most summers in semiarid areas where the peak demands on limited water resources are particularly high.

Other special circumstances requiring regulatory control include the draw down of reservoirs for the closure of power plants and the repair of dams, the release of stored water to enhance navigation or to control flows for fisheries purposes, and to prevent the erosion of stream banks.

Regulation required for dam safety purposes is part of the dam safety program under the general Flood Damage Prevention activity.

During the period under review, 58 formal engineers' orders were issued under Section 37 (1) of the Water Act.

FLOOD DAMAGE PREVENTION

Runoff Forecasting

Forecasts of total volume runoff during the spring and summer period were made monthly from February to May for all major rivers and reservoirs in B.C. by the Surface Water Section. The forecasts for 1982, reflecting the above average snowpack, were similarly above average at virtually all forecast points.

Although there were above average snowpacks throughout the Fraser and Thompson River basins, a gradual melt resulted in an uneventful Fraser River spring freshet for the province in 1982. However, flows and weather conditions were monitored and forecasting computer models were activated by the Modelling Section, as a prolonged spell of warm weather could have released the potential for major flooding. In the fall, the flood warning system for the Squamish River was operated, although no significant flood event occurred during the year.

Snow Surveys

After five years of widespread below average snow accumulation, the 1982 mountain snowpack was generally above average in British Columbia. Although there was flood potential at many locations, the cool weather persisted until the threat passed. During and prior to the snowmelt period, a total of 1363 snow surveys were made at 265 permanent snow courses by the Surface Water Section, including

many measurements to monitor the flood potential.

Snow survey staff were trained for the regions and the network regionalized in 1982. Initial field operations by regional staff were successfully performed.

Floodplain Development Control

The Planning and Surveys Section with support from staff of the Regional Engineering staff provide basic technical and administrative advice for the control of development of floodable land pursuant to Section 82(1) of the Land Title Act, and Section 3(3) of the Bare Land Strata Regulations.

In conjunction with the legislative authority, control is further exercised through the incorporation of floodproofing requirements in zoning bylaws, community and settlement plans.

A total of 353 zoning Bylaws, Bylaw Appeals and Official Community and Settlement Plans were dealt with. A total of 801 subdivisions and 204 Crown Land Lease and Fee Simple Applications were reviewed for flood control requirements. A total of 81 land referral issues to do with Flooding Reserves and Ecological Reserves were processed.

Floodplain mapping forms an important basis for planning and decision making relative to developments within floodplains. This is accentuated by the fact that a large portion of land in British Columbia suitable for development lies within floodplains.

Air photography, surveying, mapping and calculation of surface water profiles continued towards the preparation of floodplain maps. By the end of the year floodplain mapping had been completed for some 60 percent of the more highly developed areas of the province.

Some 6000 man hours were spent on topographic, bathymetric and control surveys in the Nanaimo River, Oyster River and Beaver Creek valleys. Surveys were also completed for some 120 square kilometres of floodplain containing approximately 68 kilometres of river.

Floodplain mapping was issued for the following: Columbia River between Windemere Lake and Radium; North Thompson River between Kamloops and Vavenby; Skeena River between Lakelse River and Usk; Okanagan Lake, Westbank to Peachland. To date 365 floodplain maps, extending over 963 kilometres have been produced covering portions of some 52 river and lake systems.

Substantial progress was made by consultants on a study of development management in tsunami hazard areas in Port Alberni, and on a study of floodplain management on alluvial fans.

Channel Clearing and River Protection Assistance

Under the Channel Clearing and River Protection Assistance programs the provincial government assists local authorities and private individuals with flooding and erosion problems throughout the province.

Assistance, provided by the Rivers Section and regional staff, includes investigation of problems, preparation of reports, financial assistance (usually 75 percent of the cost) and construction implementation.

Some 166 individual requests for assistance were received and 157 investigations completed, excluding a number of minor inspections and referrals for other ministries and agencies.

Because of fiscal constraints only two projects were implemented under the protection program and eight under the Channel Clearing program for a total cost of $216,000. These projects included Bella Coola River, Bellevue Creek, Barriere River, Chase Creek, Cascade Creek, Craigflower Creek, Palmer Creek, and Squamish River communities. This compares to an average expenditure of $492,000 for the previous five years.

Additional projects were implemented at Hagensborg ($200,000 special warrant), Squamish ($2,200,000 - various funding sources), Serb Creek ($37,000 Stage 1 - Fish and Wildlife funding), Lower Similkameen Indian Band ($166,000, I.N.A. funding).

The fourth year of a five-year $3,200,000 ARDSA assisted program to rehabilitate and extend the Pemberton Valley Dyking Districts's flood and erosion protection work and drainage systems was concluded with total expenditure to the year's end amoun-

ting to $2,620,000. This project continued on schedule, with work being carried out along the Lilloet River and tributaries for both the Mt. Currie Indian Band and the remainder of the Dyking District.

Work was virtually completed on the final phase of an ARDSA project providing flood and erosion protection for the Lower Similkameen Indian Band, I.R. #7, at a total cost of $1,222,000, spread over two years.

Following severe storms during 1980 and 1981, outstanding restoration work was completed at 18 locations. Total expenditures on river related restoration, excluding highway work, amounted to:

Dec. 1980 storm - $2,568,000
Oct. 1980 storm - $ 767,000

In reponse to exceptionally high snowpack readings throughout the province, staff assisted the Inspector of Dykes by undertaking pre-freshet dyke inspections and advising communities regarding appropriate precautionary measures.

Studies completed during the year included Nicola River Corridor, Kitimat Dyking, Oyster River Dyking, Cowichan Dyking and Bifurcation proposals, Squamish Dyking and Hatzic Prairie Slide Hazard Area. Work on the following studies continues: City of Merritt Dyking, City of Fernie Dyking, Mill (Kelowna) Creek Flood Alleviation, Mission Creek Dyking and Stawamus River Dyking.

An advisory service regarding the probable impact of proposed works related to watercourses was provided to other agencies and ministries under the referral program.

Policy, Procedure and Reference Manuals were prepared and a training seminar organized to familiarize Regional staff with the operation of these programs.

Fraser River Flood Control

This program, carried out under a Federal-Provincial Agreement signed in 1968, allows for an expenditure of $120 million, principally for the reconstruction of flood control works in the Lower Fraser Valley. Costs are shared equally by Canada and the Province.

Expenditures to March 31, 1983, totalled $99.6 million while expenditures for the fiscal year 1982/83 amounted to $7.6 million. This program is expected to be completed in 1985 unless further funding is made available.

Under the program, seven major projects have been completed while six others are nearing completion.

Drainage

Drainage studies and related project implementation are carried out to assist with the development of agriculture and to provide for increased production from poorly drained agricultural land. Most drainage projects are initiated through requests under the Federal-Provincial Agriculture and Rural Development Sub Agreement (ARDSA). The five year ARDSA Subsidiary Agreement was signed in July, 1977, and provides funds for carrying out engineering and economic feasibility studies, as well as for project final design and construction. The ARDSA Agreement has been extended one year to permit project approvals up to July 31, 1983.

Studies were completed for projects at Pitt Meadows, Burrows Ditch for projects at East Delta, Mud Bay and Hatzic Prairie.

Seven drainage projects were under construction, one of which, the Old Logging Ditch Drainage Scheme, at Surrey, was completed. Total value of construction during the year was $2,381,000.

Dyke Maintenance

The purpose of the dyke maintenance program, under the Inspector of Dykes, is to ensure the safety, proper maintenance, and operation of all dykes in the Province except private dykes as defined in the Dyke Maintenance Act.

Inspections were carried out in all dyking districts in the Lower Fraser Valley, Squamish, Pemberton, and Creston areas.

The Lower Fraser Valley Flood Organization was reviewed and updated in preparation for the expected high 1982 freshet of the Fraser River.

The 1982 December storms coupled with high winds and high tides resulted in overtopping of the dykes in Mud Bay, Colebrook, and Westham Island. Damage also occurred at Crescent Beach, Boundary Bay Village, and to the rock protection on the Delta Boundary Bay

Dykes.

A close watch was kept on several possible problem areas in the Lower Fraser Valley, notable: Carey Point, Harrison groyne, Newton Road in Dewdney, Nicomen Island, east end of Matsqui near Sumas Mountain, and the wing dyke area of Chilliwack.

DAM SAFETY

The dam safety program includes more than 2,000 existing storage structures in the province. Of these, 146 are classified as major structures, 76 of which were inspected by staff of the Power and Special Projects Section in the fiscal year 1982/83. In 35 cases the licensees were notified of necessary repairs.

Safety inspections involving intermediate or smaller size dams were carried out by regional staff during the year, and many of these structures were reported to their owners as being in need of remedial safety measures.

Extensive rehabilitation measures were initiated by B. C. Hydro on the 57-year-old Alouette Dam, when the structure was deemed to be marginally stable when subjected to maximum probable earthquake conditions imposed by modern seismic design criteria.

A guide for preparing Operation and Maintenance Manuals was revised and related work continued on a pilot basis with a number of dam owners. Associated instrumentation networks utilizing geotechnical instruments were monitored on potentially high hazard dams on several occasions during the year.

Staff also gave presentations on dam safety to 60 Provincial Emergency Progam Co-ordinators in conjunction with their course on disaster planning. Specialist services were provided on the Fort St. John sewage lagoons for the Omineca-Peace Waste Management regional office, an emergency inspection and repair on Groundhog Lake Dam for the Cariboo Region, and stabilization and partial removal on Deeks Lake Dam on Highway #99 under the Provincial Emergency Program.

Special Studies Geohydraulics

Investigations were carried out and reports prepared for a number of landslides and debris torrents, i.e. Williams Lake, Qualicum, Ashcroft, Spences Bridge, Haney and Alberta Creek. The latter formed part of joint investigation with the Ministry of Transportation and Highways of continuing slide problems along the Squamish Highway, affecting both traffic and local communities.

RESOURCE MANAGEMENT PROJECTS

Operation of Okanagan Lake Regulation

Snowmelt brought Okanagan Lake to within 0.2 m of full pool, however, the peak level of 0.1 m over full pool occurred in early July as a result of heavy precipitation. High river flows and high levels in Vaseux and Osoyoos Lakes resulted. Weed growth in the river channel continued to adversely affect river levels and was harvested below Vaseux Lake as required. All stilling basins were cleaned out. Responsibility for the new outlet structure and for control of water levels on Kalamalka Lake was assumed by the region in 1982.

Vedder River Management

A final draft of the Vedder Management Report, being prepared by the regional water manager, is now under review. This comprehensive report covers the implementation of flood control, recreational potential, agricultural and fisheries objectives with the management area for the Vedder River section between Vedder Crossing and the start of the Vedder Canal. The flood control works are nearing completion and both the agricultural and recreational potential of the area has been developed and implemented on an ongoing basis. It is anticipated that the total management plan will be implemented by 1984.

WATER SUPPLY PROJECTS

Supply Project Feasibility Studies

Most water supply projects are undertaken by Water Supply Section staff in response to requests for assistance under the Agriculture and Rural Development Subsidiary Agreement. This program provides funds for carrying out engineering and economic feasibility evaluation of proposed agricultural development projects, as

well as providing funds to assist in construction of approved projects.

Eleven irrigation feasibility studies were undertaken during the year, seven of which were completed. A further five requests for studies were received.

Water Supply Project Implementation

Project implementation involves both final design and construction supervision and is either carried out by staff of the Water Supply Section, or by consulting engineers.

Ten projects were being constructed during the year under the ARDSA program five of which were completed. Total expenditure on construction was $4,140,000.

The Water Supply Section provided engineering services during the year to other branches of the ministry. These assignments included carrying out the final design and construction of the Hill-MacKenzie Fish Hatchery ($650,000), preliminary design of the proposed Inonoaklin Fishway ($1,500,000), and initiation of a study to develop guidelines for stormwater management.

Community Water Supplies

The Community Water Supply Section provides the day to day technical, financial and administrative support to the Comptroller of Water Rights in the exercise of his responsibilities under the Water Utility Act and the Utilities Commission Act. This legislation provides water consumers in areas not served by water agencies of local government with assurance of standards of technical quality of community water systems and regulation of consumer costs that otherwise might not exist. In accordance with the provisions of these statutes the Comptroller regulates the activities of 258 privately owned water utilities and 34 municipally owned systems where water service is provided to properties situated outside municipal boundaries.

The authority to construct and operate these water systems is indicated by a Certificate of Public Convenience and Necessity issued by the Comptroller. In the 12 month period ending March 31, 1983, 46 applications for certificates were received. A total of 51 certificates were issued during the year compared with 79 issued in the previous 12 month reporting period ended March 31, 1982. Thirty-one of the certificates issued authorized the construction and operation of new waterworks systems or the extension of existing systems. The remaining 20 authorized the acquisition of existing works by new utility owners, amended previously issued certificates to correct legal descriptions or record the change in the name of the utility, or effected the consolidation of previously issued certificates. Approval was given to the transfer of ownership of 11 water systems during the year. Six of these were transferred to improve-ment districts, municipalities or regional districts while five were transferred to other private owners and continue to be operated under the Water Utility Act.

A total of 98 orders of various kinds were made by the Comptroller compared with 150 in the previous reporting period, and included orders for the establishment of maintenance trust funds, construction trust funds, deferred capacity trust funds, replacement reserve trust funds, and the approvals of the transfer of waterworks to new owners. The trust funds referred to above are deposited with a financial institution of the utility's choice and held there to the order of the Comptroller. At the year end the total balance on deposit amount to $4,241,361.00 compared with $4,522,029.00 held at March 31, 1982.

In the ongoing regulation of water utilities, 55 applications were received to file new or amended tariffs including rate schedules, and during the period under review 27 new or amended tariffs were examined and accepted for filing. Preliminary design guidelines for rural residential water utility systems were published.

The section continued to provide engineering support to the Ministry of Municipal Affairs in accordance with the protocol agreement made between that Ministry and the Ministry of Environment in 1979. This support comprises advice and recommendations to the Ministry of Municipal Affairs and technical support and/or guidance to improvement districts.

At the request of the Ministry of Municipal Affairs, the technical aspects of 34 by-laws were examined. Recommendations were made on 30 requests for release of special trust funds. The viability and technical implications of one proposed incorporation was examined. Fifty miscellaneous investigations and reports were made on complaints or enquiries regarding costs, service, subdivision, water sources and licensing, well tests, and easements for waterworks. Proposals for major projects were appraised, or engineering studies undertaken for three improvement districts.

Engineering support was also provided in monitoring progress in construction of 80 improvement districts' projects financed with assistance under the 1981 Improvement District Assistance Program.

The Community Water Supply Section, Victoria, is assisted by the Water Supply/Health Engineering Sections of the regional water managers' offices in the gathering of on-site information, monitoring of water construction and operations, and investigation of complaints, etc., related to water utilities and improvement districts.

Public Health Engineering

A major function of the Public Health Engineering Section and staff of the Water Supply/Health Engineering Sections in the regions is to ensure that all new waterworks construction in the province meets the minimum standards of design outlined in the section's publication "Waterworks Systems Guidelines", particularly in relation to the protection of public health. Regional Public Health Engineers are delegated by the Minister of Health to issue Final Certificates under Section 21 of the Health Act.

The decentralization of Public Health Engineering staff to the regions made it possible to provide quick response for technical and advisory services to the Medical Health Officers and Public Health Inspectors with respect to public health engineering in such matters as swimming pools, water supply, sewage disposal and others. These services were given in accordance with the agreement made with the Ministry of Health in 1978.

A total of 434 waterworks certificates of approval under the Health Act were processed during the reporting period. This compares to 935 and 763 for similar periods in 1981/82 and 1980/81.

Public Health Engineers reviewed plans and specifications for all new and renovated swimming pools reconstructed in the province other than private backyard pools. During 1982/-83, the section processed 126 pool approvals which compares with 172 and 101 for the same periods in 1981/82 and 1980/81 respectively.

Prefabricated septic tanks sold in B.C. must meet C.S.A. Standards and B.C. Health Guidelines. The program of review and approval is conducted by this section. At the year end, there were 85 valid certificates for these tanks allowing them to be sold in B.C.

Small package sewage treatment plants are handled in a similar manner to prefabricated septic tanks, and must meet prescribed standards. However, these plants must also have parts and service agencies accredited by this section. There were only three suppliers certified to sell their plants in B.C., with several times this number of service agencies accredited and located throughout the province.

The section took a very active part in the Voluntary Operator Certification Program for water and sewage works personnel. This primarily involves secretarial and record keeping functions and the administration of examinations. There are 355 certified water or sewage operators operators in B.C. This program has grown steadily over the past ten years and is one of the few in Canada. The preparation of a quarterly newsletter to the members is also a contribution by the section.

The section provided technical assistance to the Ministry of Health in setting up a program for sampling representative water supplies throughout B.C. for health related parameters and another separate program to test for trihalomethanes which, when combined with chlorine, form compounds

suspected of being human carcinogens.

Public Health Engineers provided technical and engineering advice to the Medical Health Officers concerning water treatment techniques to improve water quality to bring it within the limits set out in these standards.

WATER QUANTITY

Groundwater

The Groundwater Section collects and compiles data obtained from water well drilling activities in the province. During the fiscal year, 2,180 water well records were collected from drilling contractors throughout the province. This was a decrease of 38 percent from the previous fiscal year and is attributed to a downturn in water well drilling activities. A total of 1,514 water wells were field located, plotted on well location maps and added to the data base. Towards the end of the year, data base functions including collection, locating and plotting of wells were transferred to regional offices following the training of regional staff in this work.

Water well data are made available to the general public, and are used by government staff and groundwater consultants in various types of groundwater investigations related to management, development and protection of the province's groundwater resources. The number of enquiries answered by Groundwater Section staff totalled 646 (up 10 percent from the previous year). All water well data are currently stored in a manually operated system, and the feasibility of computerized storage and retrieval of water well data is presently being reviewed.

Seventeen environmental impact assessment Stage 1 and 2 studies were reviewed for proposed coal and metal mining projects and their possible effects on the groundwater resources. Evaluations of groundwater conditions for five strategic plans, including the Peace River, Upper Columbia, Thompson-Nicola, Elk-Flathead and Fraser Delta were at different stages of completion at the end of the fiscal year. The hydrogeological mapping program in the Saanich Peninsula Pilot Project was continued.

The section is currently monitoring groundwater levels and water quality in 140 observation wells in the province. Seven new wells were added to the network and regional staff were trained in the field maintenance and data collection functions. Information is received monthly from several key observation wells and a summary is published in the Snow Survey Bulletin. Work is continuing on a publication of historic observation well data.

The Groundwater Section undertook 31 (6 of which are continuing) groundwater assessments involving groundwater supply potential, groundwater use conflicts and problems with high groundwater levels. Sixteen well tests submitted in support of applications were reviewed for Certificates of Public Convenience and Necessity under the Utilities Commission Act.

Surface Water

The Surface Water Section participates in the coordination of the province-wide network of hydrometric stations, operated by Environment Canada under the terms of the Federal-Provincial Hydrometric Cost-Sharing Agreement (1975). There was a total of 656 stations operated in 1983, a net increase of 10 over the previous year.

The Surface Water Section assembled the stage and discharge data for 33 streamflow and 22 lake stations in the B.C. Network. During 1982 the Survey Section carried out 160 discharge measurements at 32 hydrometric network stations, maintained 12 automatic stage recorders and checked datum values at 53 manual gauges.

The Surface Water Section estimate water quantity in various creek and lakes to accommodate new or expanding water supply systems. These including Bowen Island lakes, Weston Lake on Saltspring Island, the Nicomekl and Serpentine Rivers, Williams Lake River, Inonoaklin Creek and Nicola Lake. Comprehensive hydrometeorological data summaries were prepared and return period peak and low flows estimated for gauged and selected ungauged sites as input to the preparation of Strategic Plans for six planning units.

Storage Inventory

Since the inception of the storage inventory program in 1964, ground surveys have been conducted by the Surveys Sub-section of 162 lakes and reservoirs resulting in the production of 639 maps and drawings. The drafted packages that have been prepared show underwater contours, above water contours, details of storage works, discharge curves, watershed areas and area elevation curves. An additional 20 reservoirs were surveyed in 1982/83 and a further 26 maps and drawings were produced.

RESOURCE QUALITY

Water Quality

Staff of the Surface Water Section reviewed Stage I and/or Stage II environmental assessment reports submitted by proponents for 11 coal projects and 7 metal mine projects. Detailed field office assessments of the impact of timber harvesting on water quality and quantity were carried out for three watersheds used for community water supplies.

A draft policy for the integration of forest and water management planning was completed jointly by the Ministries of Environment and Forests and submitted for approval by the ELUTC.

A management plan was completed for the Squamish Estuary by a planning committee chaired by the Manager, Resource Quality Section. This project began in 1980. The implementation of the management plan was awaiting ministerial approval at year end. Significant contributions to the plan preparation came from several units within the Resource Quality Section and several other private sector, local, provincial and federal agencies that were involved.

The Groundwater Section, which is responsible for providing technical and advisory support services on groundwater quality to government agencies, undertook investigations and otherwise contributed to 17 environmental impact assessment studies for major developments, five basin planning studies, eight groundwater protection studies and water quality concerns related to natural phenomena, the disposal of wastes and accidental spills. Twenty-eight water samples were collected for chemical analysis. Input was provided on the groundwater resource component to the province's special waste management program.

The Public Health Engineers of the ministry located in the regions advise the Medical Health Officers on the engineering aspects related to the quality of the source of supply for public water supply systems. During the year, this advice was provided for approximately 500 water supply systems.

The Water Quality Unit of the Resource Quality Section performed a wide range of functions associated with monitoring and assessment of water quality and special project problem solving.

Policy and procedure documents were prepared on water quality assessments and water quality objectives. Major commitments during the period are summarized below:

1. The preparation of strategic plans requires an assessment of all existing water quality information in priority sub-basins of a planning unit. This assessment covers discharges, the water column, sediments and aquatic life. Work was begun in 1982-83 on the following six planning units: Peace River, Upper Columbia, Skeena-Nass, Fraser Delta, Similkameen and Finlay-Omineca.
2. Water quality objectives for surface fresh and estuarine waters throughout the province are being developed in conjunction with strategic plans. Work also began on development of procedures for setting water quality objectives for coastal marine waters during the year. The main purpose of the objectives is to protect designated water uses.

   Progress was made on the assembly of water quality criteria for a number of important water quality properties, appropriate to specific water uses. Progress also was made on setting provisional objectives in certain water basins for which strategic plans are being prepared.
3. Support was provided to the Planning and Assessment Branch in interpreting the potential impact on water quality and aquatic life of proposed

industrial developments in the province. About 30 proposed developments were reviewed. These included coal mines such as Quinsam Coal, Sage Creek Coal, Quintette Coal, Bullmoose Coal, Monkman Coal and the Fording Coal expansion metal mines such as the Westmin Resources expansion and energy projects such as the Western LNG and the Murphy Creek-Keenleyside Hydro projects.

4. A publication titled "Provincial Guidelines and Laboratory Procedures for Measuring Acute Lethal Toxicity of Liquid Effluents to Fish" was released. The report was produced by a task force formed from government agencies and industry. The procedures and guidelines described are intended to produce consistent results for any one of several types of test used in the province to monitor the acute toxicity of effluents to fish.
5. A report was completed documenting measurements made in 1980 on Fraser River fish. Data were collected on heavy metals and certain toxic organic compounds in several fish species taken from the lower Fraser and, for the first time, on fish from the river upstream from Hope. Sampling extended to the headwaters at Moose Lake.
6. A report was completed on data gathered to the end of 1981 on stormwater generated from a Vancouver residential area draining to the lower Fraser River. Stormwater quantity as well as quality was measured.

   Assistance was provided to the regional office of Waste Management Branch in Surrey in a program to study stormwater from an industrial area in Burnaby.
7. A series of maps was prepared showing the acidity of lakes and their sensitivity to acid rain. This work was done as part of a Canada-wide study into the long range transport of air pollutants, being conducted by federal and provincial government agencies. In this province, data are still lacking on some lakes north of the 56th parallel. A study into the tolerance of B.C. aquatic plants to changes in pH was initiated. The results will help measure the effects of acid rain as it occurs.
8. Studies were carried out at the request of outside agencies to identify and correct water quality deterioration problems in several lakes. Reports were completed on Dragon Lake (near Quesnel), Maxwell Lake and St. Mary Lake (Saltspring Island), Skaha Lake (near Penticton) and Green Lake (near Whistler). Numerous requests for technical advice on water quality problems in other lakes and streams were dealt with. Reports on nutrient input from explosives used in mining, lake aeration for lake restoration and the effects of heavy metals on freshwater biota were completed.
9. Plans were made with Littoral Resources Unit in 1981 to design a water quality monitoring program, and to investigate the cause of declining oyster harvests in Ladysmith Harbour. Bioassays on oyster larvae in 1982 were performed to test for possible effects.

Littoral Resources

Activities of this Unit were performed by staff located in Victoria and Vernon offices. The largest staff and financial commitment of the Littoral Resources Unit was for aquatic plant management, mainly coordinated by Vernon office staff. About $200,000, or 40 percent of the total budget allocation to this unit, provided 75 percent of the operational costs of Eurasian water milfoil control projects in high use public recreation areas of six mainstem Okanagan Valley lakes and in Shuswap and Cultus Lakes. The remaining 25 percent of operational funds were provided by three local agencies under cost-sharing agreements with the province. In 1982 approximately 120 ha of Eurasian water milfoil was harvested in lakes in the Okanagan Valley. Also, during the winter of 1982-83, root removal methods (rotavating and shallow tillage) and applications of burlap bottom barriers were used to treat another 50 ha of Eurasian water milfoil, mainly in the Okanagan Valley.

Harvesting in 1982 was reduced by about 20 percent over the previous year, but increased tillage compensated

for this reduction while achieving better cost effectiveness. No herbicide treatments were required.

Because of a more than 50 percent reduction in the overall budget and diversion of about half of the Littoral Resources Unit staff to participate in other projects, some aquatic plant management functions (such as roadside quarantine and extensive surveys) were reduced or eliminated in 1982. Province-wide public information discouraging Eurasian water milfoil spread was aimed at boaters who might transport aquatic weeds. Surveillance of selected non-infested lakes was continued in 1982 and no new infestations of Eurasian water milfoil were found. Also, documentation of the benefits of control programs performed under cost-sharing and provision of technical advice to a wide range of public and private groups concerned about aquatic weeds remained a high priority. Examples of some cooperative weed control projects are:

1. Coordination of Eurasian water milfoil control to facilitate water level management and to prevent flooding below Vaseux Lake,
2. Implementation of monitoring and control programs for Eurasian water milfoil in Champion Lakes Provincial Park for the Ministry of Lands, Parks and Housing,
3. Consultation with the Peachland Irrigation District regarding control of Eurasian water milfoil in a water supply reservoir and with the South Okanagan Land Irrigation District to reduce entry of water milfoil fragments into their distribution system,
4. Assistance to Pesticide Control Branch in monitoring 2,4-D applications made by United States agencies in Osoyoos Lake.

Victoria office staff provided technical and administrative support for aquatic plant management, particularly in Cultus Lake. Staff also participated in a variety of projects, including:

1. Coordination of a joint Victoria/Vernon research project on potential biocontrol agents for Eurasian water milfoil,
2. Kalamalka Lake Park Planning Study and report completion,
3. Development of guidelines for use of the herbicide 2,4-D for aquatic weed control in British Columbia, on behalf of the Pesticide Control Branch,
4. A leading role was initiated by marine specialists in the development of water quality objectives for coastal marine waters, in collaboration with the Water Quality Unit.
5. Progress was made on development of a simplified and efficient referral system for regulatory agencies involved in approval of developments in the Fraser River Estuary, in cooperation with Environment Canada staff.

As part of aquatic plant management activities coordinated by this Unit, the Water Quality Unit surveyed selected lakes in the Okanagan and Kootenay regions for Eurasian water milfoil. Also, reports were completed documenting the results of surveys of lower mainland ponds and studies of Myriophyllum life histories.

Six major reports on aquatic plant management were completed, and work continued on four other technical reports. Policies and procedures relating to aquatic herbicide use and aquatic plant management were prepared.

Aquatic Resources

Staff assigned to the Standards and Data Unit, Resource Quality Section, continued to develop the B.C. Aquatic Data Base and to apply the Aquatic Biophysical Inventory program throughout the province. The Data Base continued to store stream data for the Ministry of Environment, the Yukon Government and industry. Hierarchical watershed codes describing drainage relationships of streams and lakes are in place for most of the province and biophysical information and mapping is currently available for about 1,500 streams.

Examples of projects initiated or completed include:

1. Coordination of a major aquatic biophysical inventory of portions of the Iskut/Stikine River system to evaluate proposed dam projects, and

2. Studies of channel properties and aquatic systems in Northern Vancouver Island (including the Tashish Watershed Study),
3. The unit commenced compilations of standard methods for all aquatic measurements made by the Ministry, to be completed in fiscal 1983-84,
4. Development of standardized classification systems for lakes and watersheds to assist water management and land use planning was begun,
5. Several cooperative aquatic habitat inventory studies were initiated with the federal Department of Fisheries and Oceans and unit staff assisted this agency in computerizing salmon escapement data.

Staff of this unit conducted four training workshops in aquatic inventory and two air photo interpretation workshops.

Inventory Operations Unit staff continued to collect specific new data on British Columbia lakes and streams, also providing existing data to assist in the production of strategic plans for the ministry. Routine provision of information from files to various public and private agencies and individuals continued.

Procedures were streamlined to provide more rapid turnaround time between field work and project completion. Certain technical improvements were also made in reports, as part of an ongoing evolutionary process.

Three stream systems and 80 lakes were surveyed as part of Ministry of Environment projects. In addition, four stream systems and 20 lakes were surveyed in north central British Columbia, on behalf of B.C. Hydro and Parks and Outdoor Recreation Division of the Ministry of Lands, Parks and Housing. This activity represented an increase over the total of five stream surveys and 85 lake surveys performed in fiscal 1981-82.

ORGANIZATIONAL CHANGE

The Aquatic Studies Branch was merged with the Water Management Branch and all its staff and functions were consolidated as the Resource Quality Section.

Pesticide Control Program

The Pesticide Control Branch is responsible for ensuring that useful, federally-registered pesticides are applied safely in the province in a manner that will not produce an unreasonably adverse effect to people or the environment.

The program controls pesticides by the following seven major objectives or activities:

1. Administering the Pesticide Control Act.
2. Evaluating and issuing permits for various types of pesticide uses.
3. Offering adult extension certification courses on the sale and safe use of pesticides.
4. Establishing standards for and issuing licences to pesticide vendors and pest control services.
5. Conducting inspections and investigations to ensure compliance with the Pesticide Control Act.
6. Supplying the public with technical information on pesticides.
7. Conducting monitoring surveys into pesticide sale and use.

Administration

Regionalization of the program is now firmly in place and appears to be functioning satisfactorily.

The Pesticide Control Branch established a new Pesticide Residues in Food Committee and assisted the Workers' Compensation Board in evaluating proposed regulations to protect farmworkers from pesticides. A set of guidelines for the aerial application of pesticides was drafted.

The regional managers and staff at headquarters completed a final draft of the Policy and Procedure Manuals.

Headquarters staff were involved in the Federal-Provincial Chlorophenol Task Force which has completed a final draft of a Code of Good Practice for the use of chlorophenols in sawmills.

Permits

One effective way pesticides are controlled is by the permit system. Use permits are required for pesticides applied to publicly-owned land or to any body of water. Restricted permits are granted for highly toxic or highly persistent compounds listed in Schedule I of the Regulations, and Special Use permits are also granted for certain research permits involving unregistered pesticides.

In terms of the permit referral system, the branch continued to work closely with regional program managers and members of the Pesticide Control Committee, which is represented by members from the Ministries of Forests, Environment, Agriculture and Food, Health, and Environment Canada. All permits are issued from headquarters through the Permits Coordinator.

There were 251 permit site inspections made (1981/82: 138 inspections). These inspections examine the potential health concerns of pesticides as well as potential environmental effects, as in previous years.

During the past year, there were appeals against 22 permits of which none were upheld by the Environmental Appeal Board.

Training and Certificates

Training, evaluation and certification of pesticide applicators and dispensers of pesticides is one of the major branch activities established to ensure that applicators and vendors of pesticides acquire the basis of pesticide technology to safely handle and sell pesticides.

The training program is designed and coordinated from headquarters and the courses are delivered, candidates examined, and certificates issued by the regional staff.

The regional staff presented 82 adult pesticide training courses and issued 2,150 certificates during the past fiscal year. Of the certificates issued, 1,300 were issued to qualified applicators and 850 were issued to qualified dispensers.

The training and certification of agricultural crop applicators was emphasized and certification of farmers applying pesticides increased from 153 during the 1981-82 fiscal year to 173 during the 1982-83 fiscal year. To meet the need for more specific training for growers of specialized crops, an applicator's course was designed for vegetable and berry growers and approximately 100 commercial growers attended the three courses in the Fraser Valley.

Headquarters issued a new publication entitled "Safe Pesticide Use Around the Home and Garden", written for the users of domestic pesticides with major distribution to consumers by retail pesticide vendors.

Preliminary steps were taken to design a training program for the regional inspectors.

Licences

The four regional offices issued a total of 1,620 licenses (840 pesticide vendor licenses and 780 pest control services licences).

Compliance

The regional staff is involved in enforcing all aspects of the Pesticide Control Act and Regulations. From the 1,765 inspections of the pesticide serv service and vendor premises, there were eight licences suspended, three permits suspended, two certificates suspended, and a total of seven charges were laid.

Occasionally, staff were involved in investigating fatal poisonings of domestic dogs, sick cattle, forestry and farmworkers, contaminated drinking water and defoliated trees. In at least half the cases, the cause was not pesticides. Last year staff also investigated several instances of highly toxic compounds being stored or shipped in leaking containers.

A major investigation involved the death of a farmworker (not a pesticide applicator) in the Fraser Valley last fall as a result of pesticide poisoning. A coroner's inquest was unable to determine the route of entry by pesticides.

Technical Information and Publicity

The branch continues to supply the public with free advice on the safe use of pesticides. A central library of all important pesticide references is being accumulated which will allow the Victoria office to act as a "nerve centre" for pesticides information in the province.

Branch staff make a habit of inviting outside speakers to the lectures for adult education courses, and also become involved in acting as guest lecturers themselves. For example, staff were involved in making regular appearances to lecture series sponsored by the Provincial Emergency Program, universities and colleges, forestry pest control committees, agricultural pest control committees, gardening and horticult- ural community groups.

Stuart Craig, the regional manager in Region 8, has continued to present a 10-minute weekly radio program on pesticides. These programs cover both general areas related to pesticide safety and use as well as regional or local topics of interest. The Penticton radio station has broadcast these programs within all areas of the Okanagan region, primarily directed to the agricultural community.

Special Studies

Work has progressed in developing a computerized permit data file which summarizes applications for permits. This summary will improve staff capability to answer questions from the public and private sectors regarding

the occurrence and impact of pesticides in the province.

A study was conducted into the lateral distance that 2,4-D residues moved after injection into alders by the hack and squirt method.

Provincial Emergency Program

The Provincial Emergency program's role in the critical area of emergency planning, response and recovery coordination continued to be exercised during this reporting period. The primary objectives of the program are:

1. To protect life and minimize damage from environmental, man-made and natural disasters by:
a) Assuming responsibility for an appropriate level of preparedness and emergency planning of provincial, regional and local government levels;
b) Initiating and participating in emergency planning with federal government, international jurisdictions, territorial governments and other provinces;
c) Ensuring the provision of warning systems, information programs and emergency reporting and response communications;
d) Coordinating emergency response and maintenance of essential services during an emergency.
2. To protect life and minimize damage from incidents by planning and coordinating effective ministry, regional and headquarters response systems.
3. To oversee recovery from disasters by coordinating the provision of disaster relief and assistance measures.

To fulfill the statutory roles and responsibilities and achieve adopted objectives, the Provincial Emergency Program continued to work with a diverse range of authorities and jurisdictions. These included:
- 30 provincial ministries, boards and commissions
- 110 municipal and regional governments
- 15 national emergency agencies
- 7 adjacent provinces, states and territories
- numerous industry groups, volunteers and interest groups.

Departmental emergency planning, the responsibility of each ministry, was the subject of an extensive review with changes to applicable regulations anticipated as a major outcome. The Provincial Emergency Plan, which summarizes the delegation of these emergency duties and functions of each ministry, was also part of this review process.

Several ministries, boards and commissions reported progress in areas as diverse as emergency social services, auxiliary police, dam safety, flooding, tsunamis, volcanic eruptions, dangerous goods transport, emergency shelter and disaster planning.

Municipal emergency programs continued to develop with the support and assistance of the Provincial Emergency Program. With grants totalling over $330,000, training services funded at a comparable level and administrative support to emergency officials and volunteers, these communities continued to benefit from these commitments.

Inter-jurisdictional arrangements included discussions, arrangements and/or agreements with the Department of Fisheries and Oceans, Employment and Immigration Canada, Emergency Planning Canada, Indian and Northern Affairs Canada, Canadian Mortgage and Housing Corporation, Agriculture Canada, the Royal Canadian Mounted Police and the Department of National Defence. The program also maintained its cooperative mutual aid relationship with neighbouring jurisdictions including northwest states of the United States and provinces/territories of Canada. The Provincial Emergency Program also maintained an active role in the Inter-Provincial Council on Civil Emergency Measures, which is a national organization of provincial emergency organizations.

PROGRAM ORGANIZATION

The Provincial Emergency Program

comprises three sections through which services, advice and assistance are provided. Program Management administers policy and procedure development, financial, personnel, and management matters. The Training Section fulfills the various training needs of volunteers, local and senior governments and other client groups. The Operations Section assists in the delivery of program services.

Six regional offices were maintained and integrated with the Regional Operations Division of the ministry. The program's head office, in contrast, reported through the Environmental Management Division during the latter part of the fiscal period.

PROGRAM MANAGEMENT

A number of cost-sharing agreements were negotiated with Emergency Planning Canada through which the province received over $300,000 towards additional supplies and services. Consultations and negotiations were also held in regard to emergency operations, war/peace roles and responsibilities, emergency training, on scene command and control and public information.

Ongoing Orders-in-Council administration accounted for disbursement of $2,575,279 and recoveries of $1,755,774.

The Province prepared for a major flood during the 1982 spring freshet due, in part, to significant snowpacks. Favourable weather and melting conditions resulted in only isolated flooding. Severe storms during the latter part of the reporting period resulted in major private and public losses and the disbursement of over one million dollars for relief and recovery measures. No Orders-in-Council for Emergency Recovery Assistance were raised during fiscal 82-83. The necessary emergency funding was provided under established votes of the legislature.

Operations Section

Operations staff continued to assist local governments in their emergency planning and coordination functions. During the reporting period, 1,306 additional volunteers were enrolled through these local programs, bringing the total number to 9,657. Affiliated with the Provincial Emergency Program, these volunteers performed a valuable service in support of a number of jurisdictions.

The composition of emergency program volunteers included:
- 4,083 Ground Search and Rescue (SAR) personnel in support of police and other SAR authorities
- 571 Marine SAR volunteers, involved in 421 tasks, supported federal authorities responsible for coastal waters
- 1,394 Air Service volunteers were involved in 52 searches coordinated by the Federal Rescue Coordination Centre
- 1,291 Auxiliary Police (special constables)
- 803 Communication volunteers
- 1,515 people in disciplines as diverse as ski patrol, mountain rescue, welfare, health, radiological protection, etc.

The Province recorded 986 operational tasks involving volunteer personnel. Callouts involved responses to 228 land searches, 115 motor vehicle accidents, 77 oil and dangerous goods incidents and 566 other emergency situations. In providing coverage for volunteer operational expenses and insurance, the Province spent $358,965, an increase of approximately 13% over last year's report. The value for dollars spent in support of volunteer operations is apparent in property savings of over $6.75 million and the removal of 1,585 lives from jeopardy. This represents a 15% decrease in the number of persons at risk and an increase of almost 20% in the value of property jeopardized compared to the previous fiscal period.

Major and disastrous events were numerous, the most noteworthy being:

Nov. 1, 1982: Slippage of an unstable slope in the South Lakeside area of Williams Lake.

Dec. 16, 1982: Storm-tide damages to dykes and private property in southwest B.C. resulted in emergency expenditures of almost $650,000.

Feb. 11, 1983: Debris torrent in Alberta Creek, Lions Bay, resulting in the loss of two lives and the expenditure of over $350,000 to restore basic community services.

Training Section

Course offerings at the Provincial College and at numerous locations throughout the province were supplemented by many local courses offered throughout the province were supplemented by many local courses offered by local emergency organizations. A total of 418 training courses and exercises were sponsored by the program, an increase of 139 over 1981-82.

The Provincial College continued to offer courses dealing with local government emergency planning, search management, dangerous goods response, tracking and basic search and rescue. over 4,100 people received training during the reporting period.

The Provincial Emergency Program is the nominating agency for B.C. candidates to federal courses at Arnprior. The program also contributed to reviews and seminars on course offerings contemplated by the federal study centre.

Dangerous Goods instruction and Disaster Planning orientation continued to be highlighted with several hundred candidates from elected positions, municipal departments and senior government offices taking advantage of these training opportunities.

Search and Rescue

AIR SERVICE

The Air Service continued to be the prototype of a federal organization being developed under the title "Canadian Air Search and Rescue Association - CASARA". In addition to its major role of assisting the Armed Forces in searches for downed aircraft, the Air Service has expanded and is being called on increasingly to provide valuable support to both ground and marine search operations. As of March 31, 1983 the program had 1,394 volunteers involved in providing their aircraft, time and expertise to Air Service training and 52 operational tasks.

MARINE SERVICE

Dispatched by the Rescue Coordination Centre or local authorities to rescue pleasure craft and commercial vessels in distress or to assist land and air searches, the Marine Service logged 421 operations and saved in excess of $5 million in property values.

Sixteen marine training exercises were held during 1982-83, a decrease from 1981-82 of approximately 15%.

LAND SEARCH AND RESCUE

Involved in 228 searches during 1982-83, these volunteers also assisted the coroner's office, health officials, police authorities and the Rescue Coordination Centre in a variety of mishaps ranging from the extraction of persons trapped at motor vehicle accident scenes to the location of downed aircraft.

These and other volunteers routinely perform an essential service to the people of the province on a year round basis. The day-to-day services they provide keep them exercised in the event that a major disaster affects the province.

COMMUNICATIONS

Reliance cannot be placed on any one form of communictions during an emergency of wide ranging proportions. The program therefore supports and encourages a diverse communications system employing a variety of radio and land-line modes. Communication volunteers provide a vital element in this emergency communication system through special frequencies and the use of a variety of communications equipment.

AUXILIARY POLICE

Special constables, volunteering their services to municipal and provincial forces, assist in augmenting patrols during peak and emergency periods. Administration for these volunteers was transferred to the Ministry of the Attorney General during the reporting period, with the program continuing its involvement in Emergency Program training and operations. The Program also maintained WCB coverage for these volunteers while alternate insurance arrangements were negotiated.

DANGEROUS GOODS

Over 400 oil and dangerous goods incidents were reported during 1982-83, of which 77 involved volunteer

personnel. The total amount spilled is estimated in excess of 3 million litres with the bulk of spilled material involving petroleum products.

Acknowledgement

The Provincial Emergency Program has representatives, contacts and involvement at provincial and local government levels in a manner unique to government. With fewer program staff than last year, it is more important than ever before that our efforts are supported by a dedicated group of volunteers and the conscientious efforts of all government representatives.

The citizens of B.C. are indebted to the 183 area coordinators and deputy coordinators, the 13 air chiefs, deputy air chiefs, and the 9,657 volunteers who give so freely of their time.

On behalf of all those beneficiaries of emergency assistance, their relatives and friends, the Province and its citizens, we extend our heartfelt thanks and appreciation to the dedicated men and women who volunteer their time and effort to make this province a safer place to live.

Assessment and Planning Division

Air Management Program

The goal of the Air Management Program is to ensure a clean and healthy atmospheric environment in British Columbia, through the following objectives:

1. Documented standards of desirable air quality for various airsheds in British Columbia.
2. Assessment of current air quality conditions, atmospheric capacities and impacts of developments.
3. Recommendations on the issuance of air emission permits, provision of emissions monitoring methodologies and staff training, and staff assistance in emissions monitoring so as to ensure compliance and thereby reach desirable standards.
4. Distribution of air quality and climatology data in usable form.

Air Quality Standards

1. A committee was established to review the province-wide air quality criteria previously established by the Pollution Control Board. By year's end, the committee had drafted its report on one major pollutant and had initiated work on three more.
2. Program staff participated in the ministry's strategic planning process for the Peace River area.
3. The program continued to provide the province's input to national air quality objectives through membership on two national committees.

Air Quality Assessments

1. Air quality data were collected at various stations across the province. This activity included the operation of 28 continuous air quality monitors, and 16,000 laboratory analyses of airborne materials. Highlights were the move of the Victoria air quality station, recognized as a class 1 station in the national network, from its previous rooftop location into new permanent quarters, and the completion of new procedure manuals dealing with air quality monitoring, laboratory analyses, and continuous monitors.
2. The special monitoring project in Prince George was continued. This project is undertaken jointly with major industry in the city, and is concentrating on hydrogen sulphide and airborne particulates, and the meteorological conditions which produce a deterioration in air quality. Additionally, a special project was commenced in Kamloops to address high levels of the same pollutants. Investigations of this type are conducted on a priority basis to produce a better understanding of an existing air quality problem, and are expected to lead to better and more cost-effective decisions on clean-up programs.
3. Automatic data loggers have been acquired to operate with the continuous air quality monitors. These will reduce the amount of time and labor necessary to extract the data, and they also make it possible to obtain hourly reports on air quality conditions by way of special telephone connection. Monitoring stations in Prince George, Kamloops and Trail have been equipped with this telephone connection, enabling regional staff to deal with poor air quality conditions when they occur.
4. Staff conducted the first full audit of all continuous air quality monitors operated by industry across the province. Several of the monitors were found to be significantly out of calibration and follow-up was necessary. The audit will be repeated on a regular basis to ensure that the data collected by industry meets ministry standards.
5. A variety of projects were undertaken to address concerns about acid rain. An analysis of rainfall from individual storms was included in a report dealing with the Prince Rupert-Terrace-Kitimat area, where above-

normal acidity values have been observed. Preparations were made to install six permanent acid rain stations in locations which will complement the federal government's seven stations in the province. Preliminary maps were prepared depicting soil sensitivity and lake sensitivity to acid rain. Additionally, an inventory of sulphur dioxide emissions within the province was undertaken since these gases are a principal contributor to the formation of acid rain. All acid rain research activities are being coordinated with the federal government and the other western provinces.

6. Program staff have participated in joint industry/government committees monitoring changes in coal dust levels in northern British Columbia and investigating coal dust concerns in the southeast.

7. The full set of air pollution dispersion models routinely used by the Environmental Protection Agency in the United States was purchased for implementation on a ministry-owned computer in order to provide better and less expensive estimates of the impacts of emissions. Three of the models were operational at year's end.

8. A dispersion training course was developed for staff specialists, and a "hands-on" introduction to the three computer models was planned for staff in the Air Management and Waste Management programs.

9. In support of the strategic planning process, staff investigated the use of air pollution climatology for such planning exercises.

10. The requirement for wind stations in direct support of air quality assessments was reviewed, and the meteorological network was reduced by approximately 25 percent. At year's end a total of eight of these stations remain in operation. Equipment was purchased to automate the data handling of a majority of these stations.

11. The operations of 226 climatological stations were coordinated by the program, collecting a variety of data on temperature, precipitation, wind and solar radiation. The costs for field operations of 58 percent of these stations are borne by other ministries and agencies. A review of all stations was undertaken to determine whether the original purpose of each station had been accomplished and whether stations could be discontinued.

12. Staff reviewed 25 environmental assessment reports, and appeared as expert witnesses before the B.C. Utilities Commission hearing on the Site C hydroelectric proposal.

13. Preparations were made to provide a training course on the operation of climatological stations for program staff and cooperating agencies.

Emissions

1. The Program embarked on a major initiative to improve the ministry's enforcement capability for air emissions. A new provincial code for sampling particulate emissions was completed, as well as a corresponding procedure manual. Existing equipment was upgraded and one new sampler purchased, and preparations for staff training were initiated.

2. A sulphur dioxide emissions inventory was completed, revealing a large decrease in total provincial emissions since 1976.

3. A total of four training courses were provided in various locations for smoke opacity monitoring, and the smoke generation unit and trailer were repaired.

4. A report was published summarizing the results of the automobile emissions tests conducted in 1981 in Vancouver in a joint project with Environment Canada and the Ministry of Transportation and Highways.

5. In a joint project with Environment Canada, dioxin emissions were sampled at one location in order to develop a satisfactory sampling method.

Distribution of Data

1. Computerized data files containing all air quality and climatological data for the province were maintained, and computer programs were developed to extract federal and provincial climatological data and statistics from the data file.

2. Staff responded to a total of 222 individual requests for climatological

data, and prepared five data analysis reports.
3. Two editions of the "Climate of British Columbia," 1979 and 1974-76, were produced in microfiche format.
4. A format was developed for an annual summary of air quality data throughout the province, and the data presentation for 1980 was almost completed.
5. A format was developed for a monthly internal report which will draw attention to situations where air quality criteria are being exceeded.
6. An analysis of air quality trends was initiated.

Surveys and Resource Mapping Program

On October 1, 1982, the former Surveys and Mapping and Terrestrial Studies Branches were joined to become the Surveys and Resource Mapping Branch. Its major focus is on the production of base maps and a variety of biophysical maps and data. Projects and activities related to environmental assessment and management and socio-economic development are the major beneficiaries of the branch's products and services.

A detailed review of the new branch was initiated during the year to define its widerange of goals and objectives and determine where further production and service efficiencies can be achieved. Emphasis is being placed on goals and objectives which can be measured and quantified over the short, medium, and longer terms. The Director, along with senior staff, continued to participate in regular meetings of the Mapping Program Steering Committee, an interministerial-interagency coordinating group responsible for monitoring the progress of the Provincial Base Mapping Program.

With the introduction of digital base mapping and its attendant close relationships to photogrammetric plotting, it was considered operationally beneficial to combine both activities into a single unit. Another operational efficiency was achieved by formation of an administrative subunit to interface with Financial Services for processing and recording fiscally-related transactions such as purchase orders and MAPS-BC receivables.

As the result of the government's decision early in 1983 to acquire aerial photography through private contract, staff of the former Air Photo Unit were re-assigned to the Programs, Planning and Policy Section, where they will screen and evaluate ministries' air photo requirements and liaise with private sector contractors and other ministries.

A major technical and production efficiency was achieved in digital mapping through replacement of the former PDP11/44 central processing unit with the more flexible and higher-capacity VAX-11/751 processor. Production of digitally produced base maps is expected to rise significantly as a result.

A total of 454 large scale (1:2 000, 1:2 500, and 1:5 000) urban series and 705 medium scale (1:10 000 and 1:20 000) resource series base maps were completed. Forty-six base mapping projects were completed in full. Eight others were carried forward, largely because of the addition of four projects to those originally scheduled, activation of a standby project, and extensions to jobs underway. Eighteen out of a scheduled 19 special base mapping projects were completed. These off series sheets were primarily needed for specialized site-specific hydrologic studies within the ministry.

Six new full colour lithographed maps were published and 25 existing sheets were reprinted to replenish stocks depleted by demand. The map and air photo distribution office, MAPS-BC, sold and distributed 176,509 maps and 247,809 standard air photos.

Integrated survey work was carried out in nine centres (Vancouver, North Vancouver, Kamloops, Coldstream, Burnaby, Oak Bay, Tumbler Ridge, Delta, and Nanaimo) and mapping control placed and targetted in nine other areas of the province. Staff of the Air Photo Unit flew coverage for 7,354 photographs, while another 6,006 were obtained under private contract during the 1982 photographic season.

Contract Mapping

Twenty projects, valued at $1,363,976, were awarded under the Contract Mapping Program, in which production of base maps and services ancillary to them are contracted to the

private sector. The Contract Mapping Program takes two forms. One is the Large Scale Base Mapping Cost-Sharing Program which was established to assist Municipalities and Regional Districts to help themselves in acquiring base mapping that would meet provincial standards as defined by the Director of the Surveys and Resource Mapping Branch. The second is a program whereby the branch engages the surveying and mapping services of the private sector to carry out base mapping. In both cases formal agreements are administered by the Projects Unit of the branch's Programs, Planning and Policy Section.

TERRESTRIAL STUDIES

The function of the Terrestrial Studies Section is to serve the information needs of Ministry of Environment programs, and to provide similar skills and services for financially supported requests from other public and private agencies. The section provides information on soils, terrain, vegetation, wildlife habitat, and coastal resources. Through the Computer Aided Planning, Assessment and Map Production (CAPAMP) and B. C. Soils Information System (BCSIS), information is stored and is readily available for other section activities (soils, vegetation, terrain, etc.) on a province-wide basis. Drafting, graphs, autocartographic, and map library services are also provided for Terrestrial Studies and other Ministry of Environment programs. The map library was administratively amalgamated with MAPS-BC so that their service and distribution functions could be shared.

Activities of the section include:

1. Field work and map preparation of biophysical resource inventory.
2. Development of methodology and preparation of manuals and forms to standardize data collection procedures and data storage.
3. Participation in Strategic Planning for the Ministry of Environment Planning Program.
4. Involvement in studies requiring specialized skills to solve complex resource issues.
5. Continued Computer Aided Planning and Assessment Map Production (CAPAMP) development and implementation of computerized data storage, retrieval, and automated outputs, including interpretive maps. Digital capture of resource map information and accompanying data was completed for over 100 mapsheets-input at 1:50 000 and 1:20 000 scales for Soils, Terrain, and Agriculture capability.

RESOURCE INVENTORY

1. Four estuaries were mapped at 1:5000 scale and field work completed on another three.
2. Twelve Biophysical Ungulate Capability mapsheets at 1:50 000 scale were completed.
3. Completed preliminary mapping and problem analyses for Biotic Regions of British Columbia.
4. Completed soils and vegetation maps for the Keremeos Bighorn Habitat Improvement project; completed Salmon River Elk Habitat Study.
5. Field work for soils and terrain completed for Deep Basin in the Northeast Coal Project.
6. Field work at 1:250 000 scale for Dease-Stikine completed for soils, terrain hazards, and wildlife habitat for B. C. Hydro.
7. Vancouver Island Fine Tuning completed for four 1:20 000 soils maps for 25,000 hectares in the Nanaimo to Qualicum Beach area, for the Ministry of Agriculture and Food.
8. Settlement suitability for Atlin map completed for Ministry of Municipal Affairs.
9. Vegetation and soil maps completed for the Dewdrop area near Kamloops for mule deer winter range, in cooperation with Fish and Wildlife Branch, Ministry of Forests, and forest companies; and four vegetation landscape maps prepared for the Purcell Mountain Study Area.
10. Terrain maps for the Goat-Milk River area near McBride for the Ministry of Forests, and for Saltspring Island for Islands Trust and Agriculture Canada.
11. Prepared CAPAMP derived soil capab-

ility for wildlife maps for the Similkameen Strategic Plan Unit.

12. Completion of a draft 1:2 000 000 map of B. C. "Soil Sensitivity to Acid Precipitation" with accompanying draft report describing methods and limitations.
13. Completion of a folio of transparent maps (1:100 000) identifying constraints for siting a secure landfill for special waste disposal, and use of the multiple overlay method for identifying least constrained areas.
14. Completed drafting of 1:50 000 Aquatic Biophysical mapping for the Stikine-Iskut area in cooperation with Water Management Branch for B. C. Hydro.
15. Completed detailed Agriculture Capability map for 60 inspections of ALR lands for the Provincial Agriculture Land Committee.

PLANNING AND RELATED STUDIES

1. Provided specialist support for Thompson-Bonaparte, Upper Columbia, Peace River, Similkameen, and Fraser Delta Plans related to soils, terrain, vegetation, irrigation requirements, and wildlife habitat.
2. Coordinated resource input for the Slocan Land Use Plan.
3. Provided soil interpretations for revising the classification of grazing land in the agricultural land reserve near Kamloops.
4. Completed Brooks Peninsula Paleoecology study.
5. Conducted studies to improve previously collected waterfowl census data.
6. Further application of the method and equipment (fluorometer and conductivity meter) for detection of septic tank leachate inflows from near shore disposal to several lakes (Round Lake, Kathlyn Lake, Tyber Lake).
7. Completion of estimates and reports of loading of phosphorus from non-point sources to Tie Lake, Columbia Lake, and Windermere Lake for the Waste and Water Management Branches.
8. Undertook a soil moisture study as part of the ALR Fine Tuning Program as a basis for defining irrigation water needs.
9. Coordinated a Wildlife Habitat Handbook Project and assisted in development of a Memorandum of Agreement between the Ministries of Environment and Forests.
10. Prepared a priority rating system for coastal wetlands and applied the system for the coastal mainland and Vancouver Island. In cooperation with regional staff 405 coastal wetlands were evaluated.

PUBLICATIONS

1. Provided graphic services and coordinated the printing of 60 technical and data reports submitted by the section as well as Water Management, Waste Management, and Planning and Assessment Branches.
2. A Terrain Interpretation Booklet and a Terrain Inventory Classification Manual were prepared for publication.
3. Completed a manual titled "Outdoor Recreation Classification for British Columbia" with the Outdoor Recreation Branch of the Ministry of Lands, Parks and Housing.
4. Developed a manual titled "Forage Capability Classification for British Columbia" for cattle and wildlife.
5. Developed a manual for classifying land capability for agriculture, in cooperation with the Ministry of Agriculture and Food.
6. Completed development of a directly key enterable wildlife data form, with supporting procedures.
7. An estuary habitat mapping methodology manual was completed for publication.
8. Reports published on vegetation included:
   a) Capability of common coniferous trees in British Columbia,
   b) An illustrated Key to the monocotyledon Families of British Columbia,
   c) An Illustrated Key to Dicotyledon Families of British Columbia,
   d) Plant herbarium list at the Kelowna office, and
   e) Vegetation Resources of the Vernon area.